ARCHITECTURE DEPARTMENT

MASTER OF ARCHITECTURE PROGRAMME

CHINESE UNIVERSITY OF HONG KONG

2010-2011 DESIGN REPORT

COURTYARD IN MASS HOUSING – APPLYING CONCEPT OF COURTYARD HOUSE & QUADRANGLE IN HOUSING ESTATE INTO MASS HOUSING IN HK

LAI Pui Man May 2011

COURTYARD IN MASS HOUSING

Applying concept of courtyard house & quadrangle in housing estate into mass housing in HK

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香港中文大學
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DEFINITION

COURTYARD
noun

Oxford Dictionaries Online

an unroofed area that is completely or partially enclosed by walls or buildings, typically one forming part of a castle or large house.

Courtyards : aesthetic, social, and thermal delight, John S. Reynolds

- an enclosed area that is outside yet almost inside, open to the sky, usually in contact with the earth, but surrounded by rooms or buildings.

- The courtyard is closely related to its surrounding rooms, serving them as both a conduit and a filter of daylight, night darkness, wind, rain and sound.

- Courtyards provide people with daily contact with nature and moderate nature's extremes.

QUADRANGLE

Oxford Dictionaries Online

noun
an open square area that has buildings all around it, especially in a school or college

LIGHT WELL
noun

Wikipedia

an unroofed external space provided within the volume of a large building to allow light and air to reach what would otherwise be dark or unventilated area

Kevin Lynch

Site planning, Kevin Lynch

Courtyard House

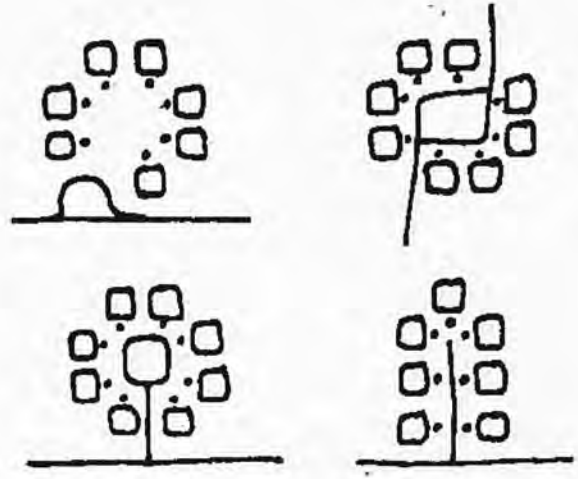
The courtyard house, in which single-family units are packed closely together, side by side and back to back, and have their open space within their walls rather than outside of them. This derives from an old Mediterranean prototype, and allows the privacy, control, and directness of access of single-family houses to be provided at much higher densities.

Site planning, Kevin Lynch

Court arrangement

Court arrangement is that groups of units are faced inward on a common open space. This is done primarily for social and visual reasons: to promote neighborly relations and to provide pleasant enclosed spaces. Vehicular circulation may be allowed to enter the court, or may pass through it in some indirect fashion, as in the square, or may be excluded from it as in the English "close".

The court with its circulation may shrink to the width of a cul-de-sac. The internal space of the court or cul-de-sac may be open to the street, forming an inlet of the major street space, or the entrance may be narrowed or even formalized with a gateway, so as to produce an independent space. The land on the outside of the courts may be committed to public open space, to private yards, or to service access.



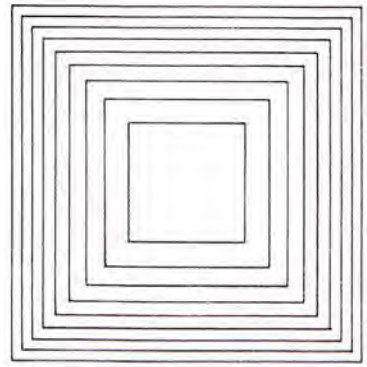
Leslie Martin

"The Grid as Generator", Urban space and Structures, Leslie Matin and Lionel March

Grid as Generator

In the Fresnel's diagram, each successive annular ring diminishes in width but has exactly the same area as its predescessor. The outer band in the square form of this diagram has exactly the same areas as the central square. And this lies at the root of our understanding of an important principle in relation to the way in which buildings are placed on the land.

The central square (which can be called the pavilion) and the outer annulus (which can be called the court) are two ways of placing building on the land. On any large site a development covering fifty per cent of the site could be plotted as foty-nine pavilions, as shown in Fig. 2, and exactly the same site cover can be plotted in court form. A contrast in the ground space available and the use that can be made of it is at once apparent. but this contrast can be extended further: the forty-nine pavilions can be plotted in a form which is closer to that which they would assume as buildings. This can now be compared with its antiform, the same flow space planned as courts (Fig. 3). The comparison must be exact: the same site area, the same volume of building, the same internal depth of room. And when this is done we find that the antiform places the same smount of floor space into buildings which are exactly one third the total height of those in pavilion form. Fig. 4 shows the widely different effects of placing exactly the some count of floor space on the same site. Clearly there are choices.



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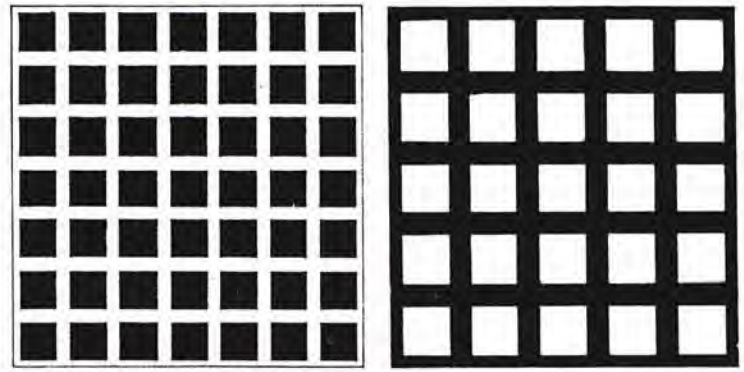

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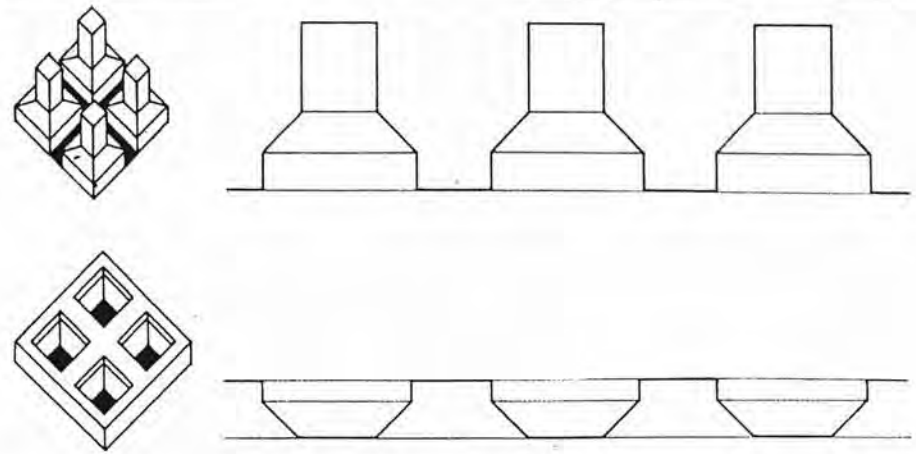

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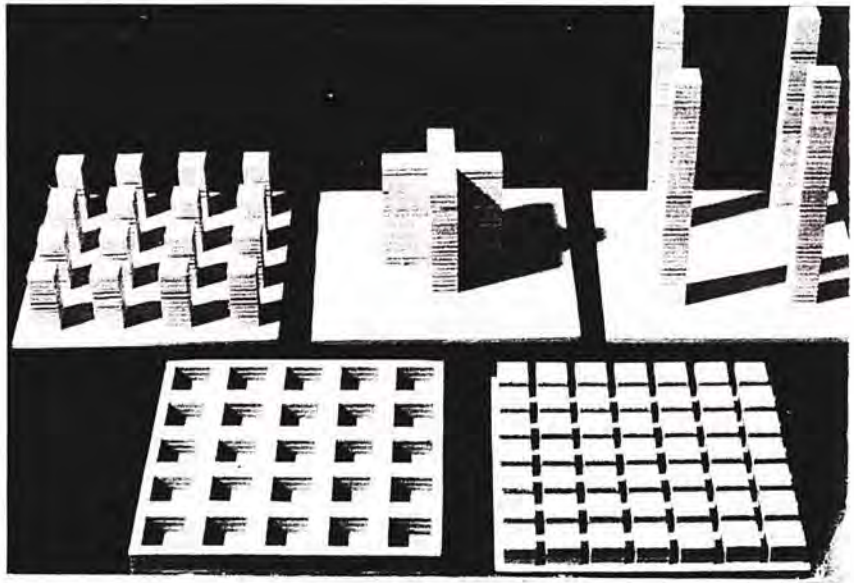


4

Mies van der Rohe

"Court-house"

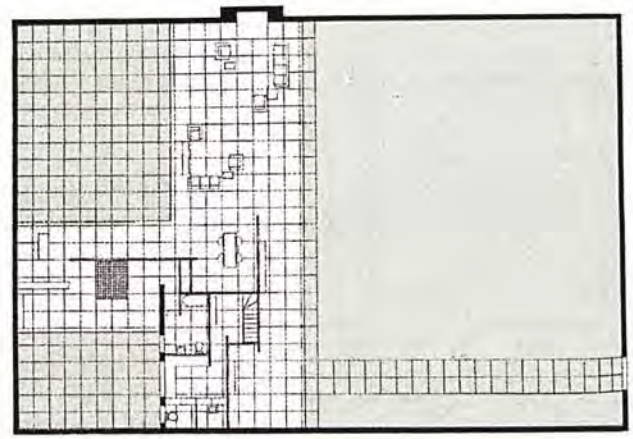
Ludwig mies van der Rohe, Werner Blaser

At the beginning of the 1930s, in Dessau's Bauhaus and later, after emigrating to the Illinois Institute of Technology in Chicago, Mies van der Rohe had also brought the idea of the courtyard house to life in urban forms which enabled open and spacious living within the constraints of expensive urban land.

West meets East : Mies van der Rohe, Werner Blaser

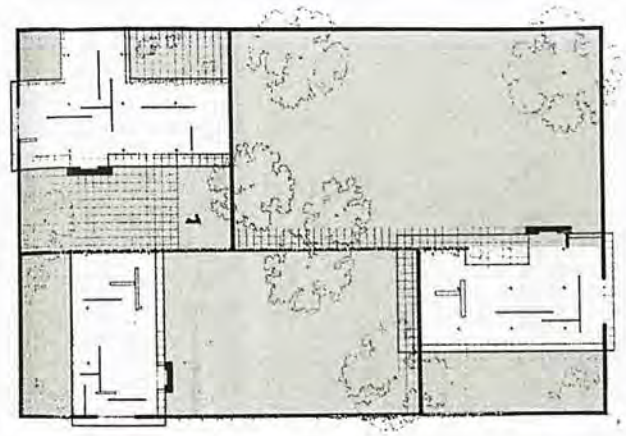
"From 1931 to 1938 Mies developed a series of projects for "court house"... in which the flow of space is confined within a single rectangle formed by the outside walls of courtyard and house conjoined."

Each house is relatively small and enclosed in glass. It spans the width of the lot, which is defined by brick walls abutting the house. A large open area, planted with grass and vines, provides a relatively expansive view from the main living areas and distances the house from the street. Smaller, paved courts at the back of the lot are more introspective and bring light and air into the more private areas of the house. The number and size of the paved courts reflect the complexity and scale of the individual house types.



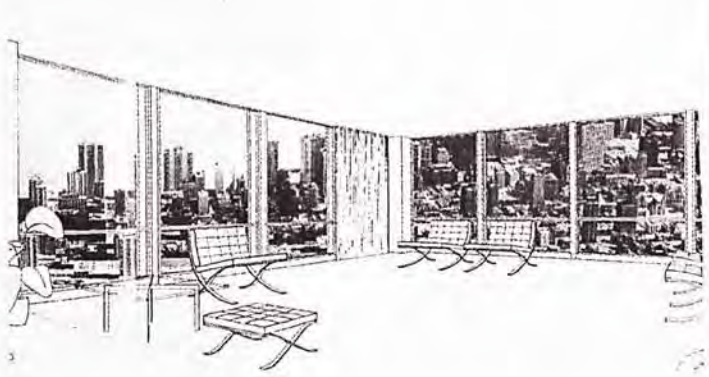
Mies van der Rohe, Philip C. Johnson

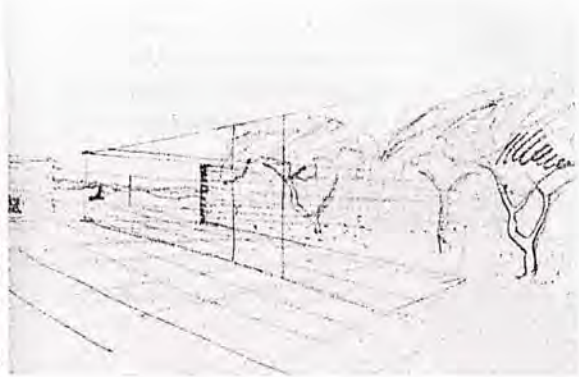
In his conception of the courtyard house, courtyard or garden are somewhat displaced from the centre towards an outer wall, without the central significance of intimacy and shelter becoming lost. The design has permeation of interior and exterior and the opening to the garden extending the full width of the house.

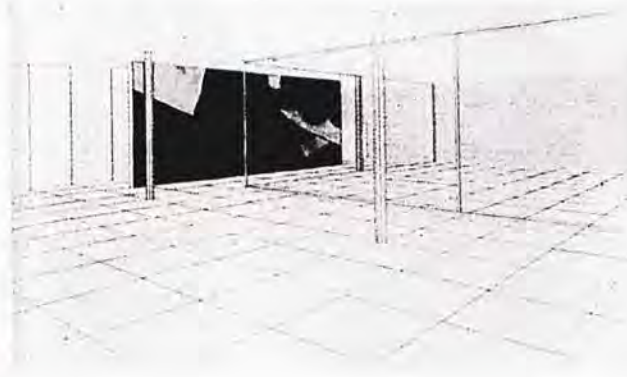


West meets East : Mies van der Rohe, Werner Blaser

The exterior of the landscape enters the world of interior: the experience of space within nature can greatly enrich our perception and sympathy for beauty. Such "naturalness" has for centuries determined the open plan.







SANAA

Architectural Topology, El croquis no. 139

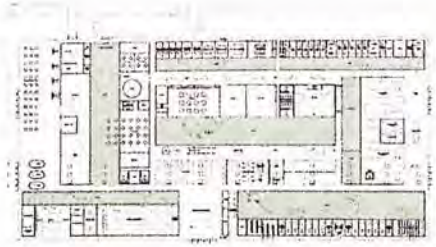
Exchangeability between Interior and Exterior

It is based on the equality of geometric figures between the interior areas and the courtyards, which makes them equivalent to each other on the building's plan.

In the Seijo Town Houses in Tokyo 2005/2007, a variety of outdoor spaces extend the interiors: courtyards at basement level, the small gardens on the ground floor and terraces on the roofs of some of the volumes. These are outdoor living spaces that establish relationships of equivalence with the rooms in the different apartments.

Project Summary, El croquis 77 + 99

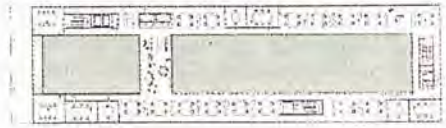
The Centre for the Illinois Institute of Technology Campus has a series of longitudinal courtyards with equivalent shapes and sizes to the work areas that they separate and define, thus using even the size and shape parameters to deny the hierarchical distinction between indoor and outdoor spaces, and establish an equivalence between them. These courtyards "act as private garden for each area" in a building that "is both architecture and park, designed as an extension of the 'Center Garden'".



Architectural Topology, El croquis no. 139

Atmospheric Effect

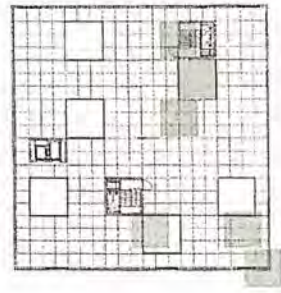
The atmospheric effects in Sejima and Nishzawa's buildings are produced by the qualities – transparent, translucent, reflective – of the materials used for walls, including the boundary of the courtyard. In many cases, however, the way these walls are arranged is also an important part of this effect.



Project Summary, El croquis 121/122

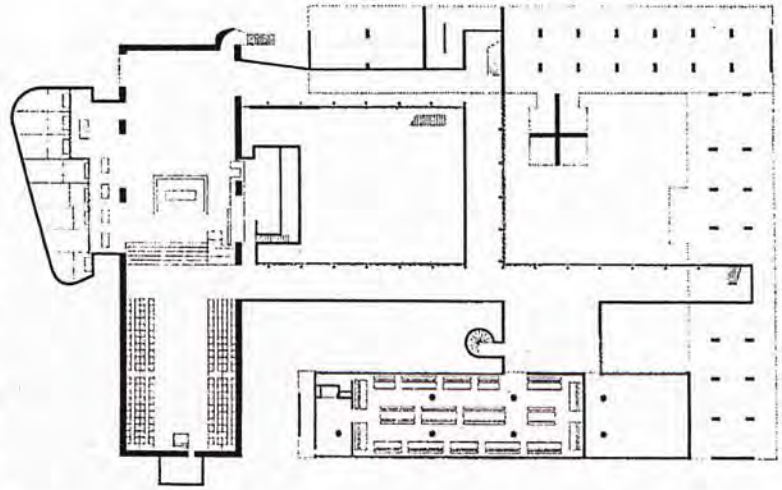
The continuity of the transparent glass walls in the Novartis office Building in Basel, 2002/2006, and the narrowness of its bays – arranged around a courtyard – "benefits a high degree of transparency and equal exposure to the surroundings and the courtyard". The effect that this has on a visitor to the building is one of great openness throughout the building – almost a sense of being outdoors – while one's gaze crosses the bays directly due to their narrowness.

On the third floor of the Zollverein Design School, which contains office around six courtyards and a perimeter corridor, the user experiences multiple transparencies and overlapping reflections between the corridor, the courtyards, the work areas, the roof terrace and the sky through this courtyards.



Le Corbusier

Le Tourette



Cloister

The Monastery of Sainte Marie de La Tourette, Philippe Potié

Cloister pathways disrupt the traditional courtyard garden, which appears on the roof. Despite their symmetrical positioning, the courtyard corridors have one blank and one glazed wall with ondulatoires.

The Le Corbusier Guide, Deborah Gans

The cloister has sides walls made of undulatory glass and the monks can use it in all weathers. It cuts through the square of the courtyard, linking the monastery wings and the church along the shortest line. The perimeter corridors end in window blocked by a concrete panel, which Le Corbusier called a "flower of ventilation".

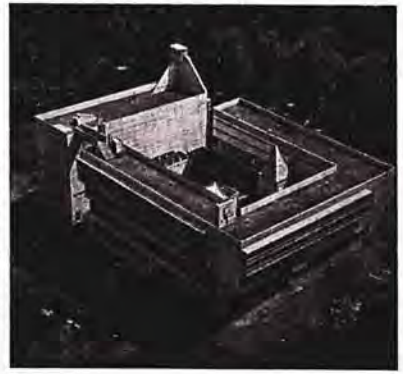
The Monastery of Sainte Marie de La Tourette, Philippe Potié

The traditional perimeter cloister is displaced to the roof as a solitary walk, but the parapet is built so high as to eclipse the very panorama it might have offered. Prayer walking round and round the flat roof beneath arches that were supposed to have crowned the edifice. A wall measuring 1.83m (the height of a man) was put up to prevent the monks from gazing out to the maze of surrounding hills, thus ensuring that they concentrate on the spiritual task on hand.

Living Cells

The Monastery of Sainte Marie de La Tourette, Philippe Potié

There are two floors of cells on the top of the monastery. One arrives in a corridor that runs along the three wings of living quarters leading to all the cells. The corridor is 2.26m wide with 33cm-high horizontal slits placed at a height of 1.42m. The slits offer vivistors long zoomlike views of the building's interior shapes. The theme of the strip window is afforded a cinematic dimension, serving as a backdrop to the architectural narrative of the cloister as it unravels like a ribbon. The vistas are tightly framed by the slits.



Lighting

Refectory Floor

La Tourette : the Le Corbusier monastery, Anton Henze

The refectory is the festive room of the monastery with more light. It has a chequered glass wall on to the courtyard.

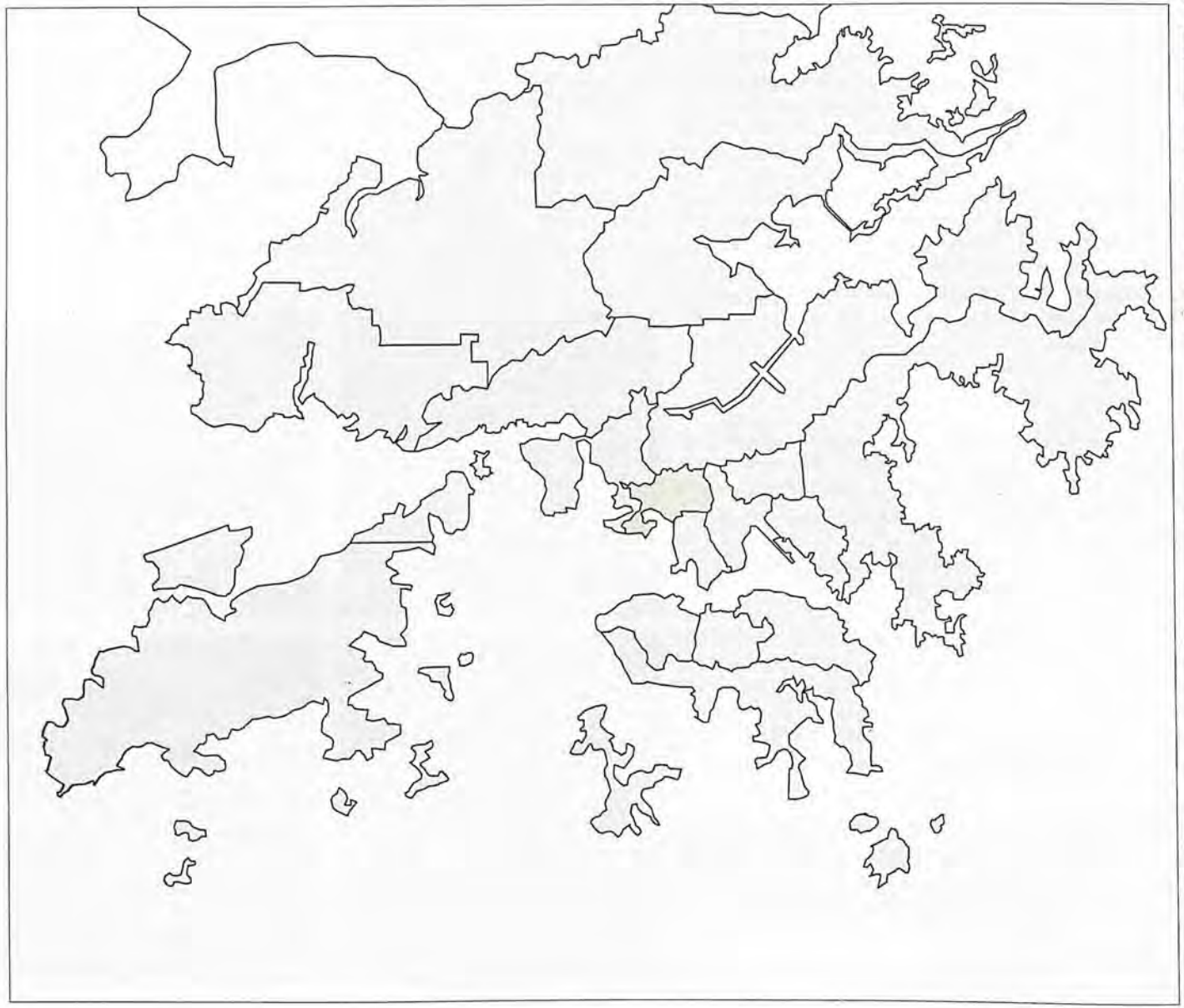
Entrance Floor

La Tourette : the Le Corbusier monastery, Anton Henze

The common room and library open only on to the courtyard. The walls facing the courtyard are transparent and are made of concrete frame and glass panels. For the remaining part facing the courtyard on the entrance floor, corridor, same kind of glass wall is used for the light penetration.

ADVANTAGES OF COURTYARD

- enables a relatively dense settlement with numerous dwellings.
- symbolically untied with the fundamental meaning of living: sheltered enclosure and openness to the outside world
- more communal space for activities and communication to enhance the human relationship
- more private open space for outdoor exercise



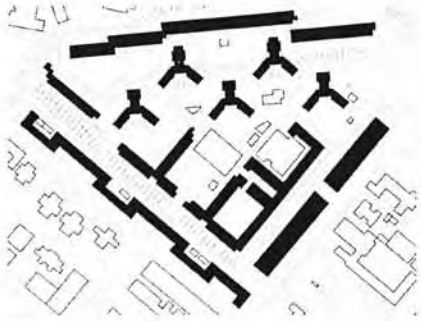
Sham Shui Po includes Sham Shui Po, Cheung Sha Wan and Lai Chi Kok of New Kowloon, and Stonecutter's Island of Kowloon. As Sham Shui Po was one of the earliest developed districts in Hong Kong, Sham Shui Po was already a densely populated district in 1950s and 1960s. As of 2003, Sham Shui Po is covered mainly by residential buildings, with public housing estates built on approximately 810,000 m^2 of land.

Sham Shui Po is an area where urban decay is serious in Hong Kong. Most of the old public housing in Sham Shui Po (e.g. Shek Sip Mei Estate and Pak Tin Estate etc.) are under re-development. There are old and new types of public housing in this district for study.

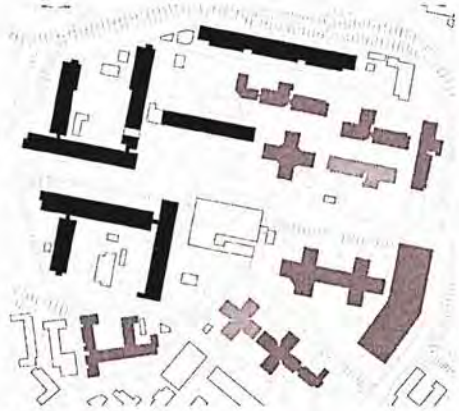
N
0
50
100
250m

COURTYARD CREATED CLEARLY

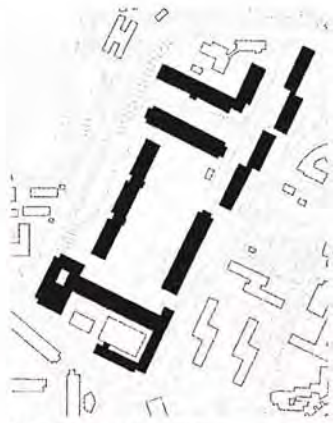
UNCLEAR



SO UK ESTATE



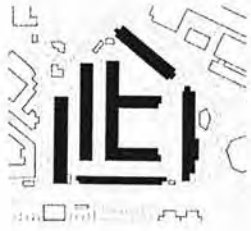
PAK TIN ESTATE



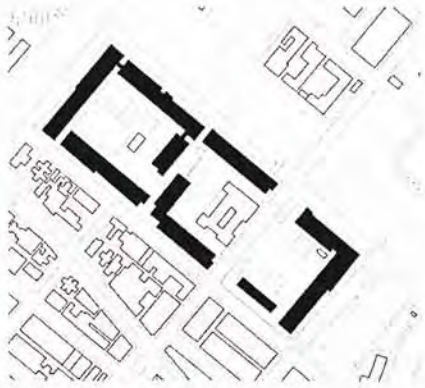
NAM SHAN ESTATE

LAI KOK ESTATE

1960 1965 1975 1976 1977 1980 1981 1983



TAI HANG SAI ESTATE



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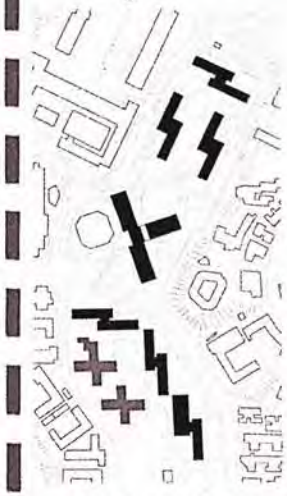
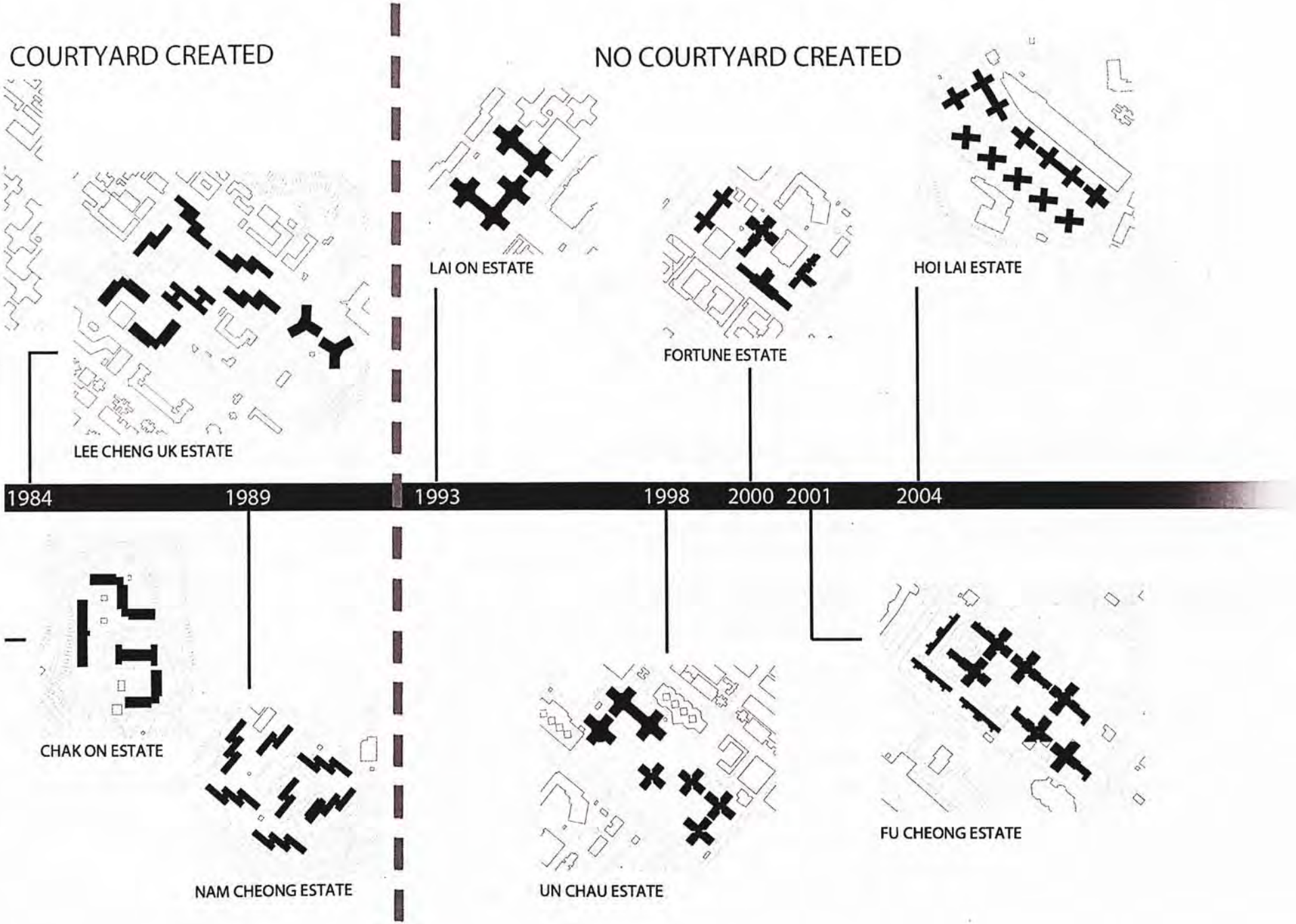
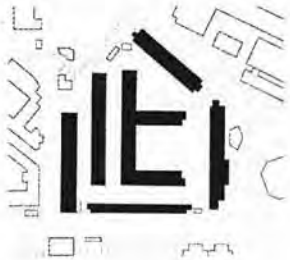


TAI HANG TUNG ESTATE


COURTYARD CREATED
NO COURTYARD CREATED
LEE CHENG UK ESTATE
LAI ON ESTATE
FORTUNE ESTATE
HOI LAI ESTATE
1984
1989
1993
1998
2000
2001
2004
CHAK ON ESTATE
NAM CHEONG ESTATE
UN CHAU ESTATE
FU CHEONG ESTATE

COURTYARD CREATED CLEARLY



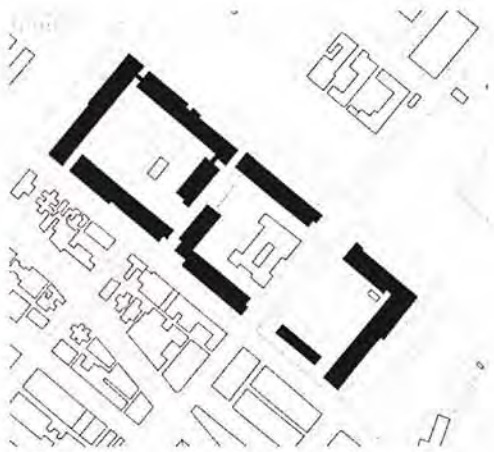
TAI HANG SAI ESTATE

SITE AREA = 21338.48 m²
FOOTPRINT = 7716..20 m²
SITE COVERAGE = 36.16 %

NON-DOMESTIC
GFA = 5340.72 m²
PLOT RATIO = 0.25

DOMESTIC
GFA = 72316.95 m²
PLOT RATIO = 3.39

TOTAL
PLOT RATIO = 3.64



SHEK KIP MEI ESTATE

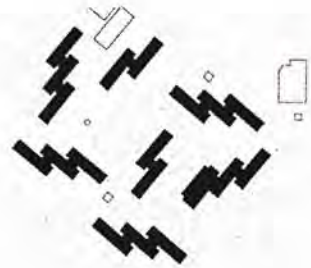
SITE AREA = 27922.26 m²
FOOTPRINT = 14911.84 m²
SITE COVERAGE = 53.40 %

NON-DOMESTIC
GFA = 19595.83 m²
PLOT RATIO = 0.70

DOMESTIC
GFA = 111351.01 m²
PLOT RATIO = 3.99

TOTAL
PLOT RATIO = 4.69

UNCLEAR



NAM CEONG ESTATE

SITE AREA = 45135.07 m²
FOOTPRINT = 9150.31m²
SITE COVERAGE = 20.27 %

NON-DOMESTIC
GFA = 15939.01 m²
PLOT RATIO = 0.35

DOMESTIC
GFA = 117394.77 m²
PLOT RATIO = 2.60

TOTAL
PLOT RATIO = 2.95

COURTYARD CREATED

CHAK ON ESTATE

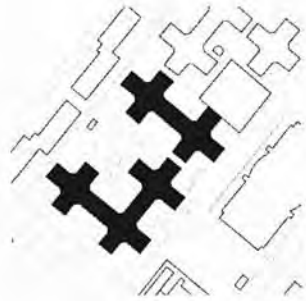
SITE AREA = 32961.47 m²
FOOTPRINT = 7629.76 m²
SITE COVERAGE = 23.15 %

NON-DOMESTIC
GFA = 8603.67 m²
PLOT RATIO = 0.26

DOMESTIC
GFA = 83928.33 m²
PLOT RATIO = 2.55

TOTAL
PLOT RATIO = 2.81

NO COURTYARD CREATED



LAI ON ESTATE

SITE AREA = 18117.31 m²
FOOTPRINT = 6663.56 m²
SITE COVERAGE = 36.78 %

NON-DOMESTIC
GFA = 6663.56 m²
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DOMESTIC
GFA = 93289.84 m²
PLOT RATIO = 5.15

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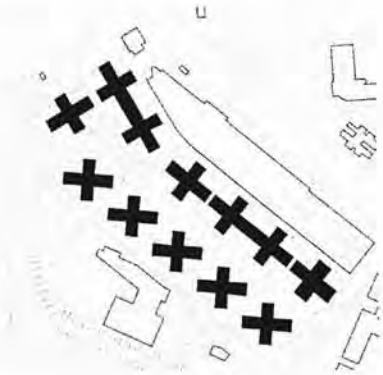


HOI LAI ESTATE

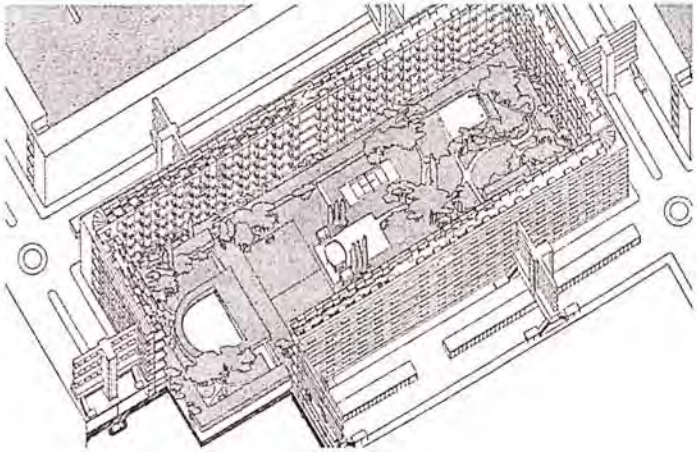
SITE AREA = 47355.47 m²
FOOTPRINT = 16925.49 m²
SITE COVERAGE = 35.74 %

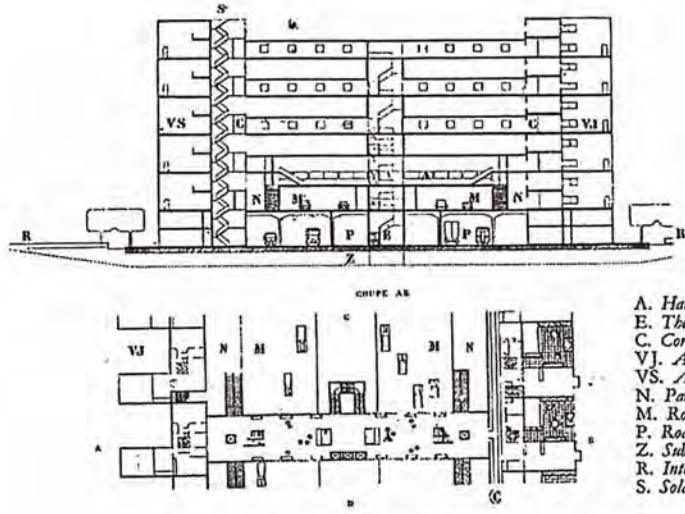
NON-DOMESTIC
GFA = 24335.23 m²
PLOT RATIO = 0.51

DOMESTIC
GFA = 282039.90 m²
PLOT RATIO = 5.96

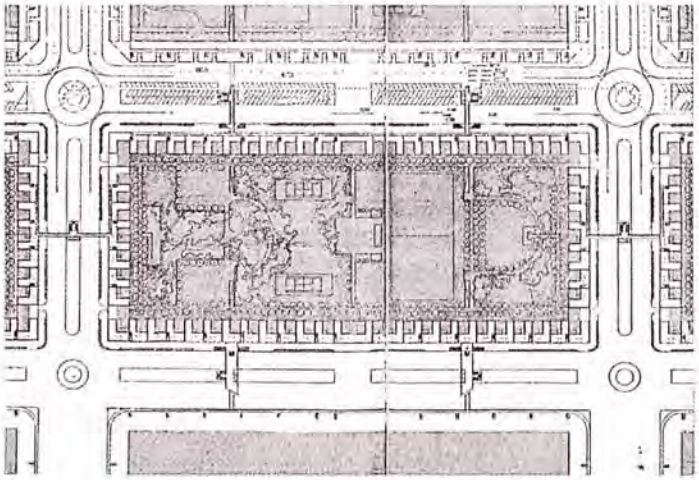
TOTAL
PLOT RATIO = 6.47

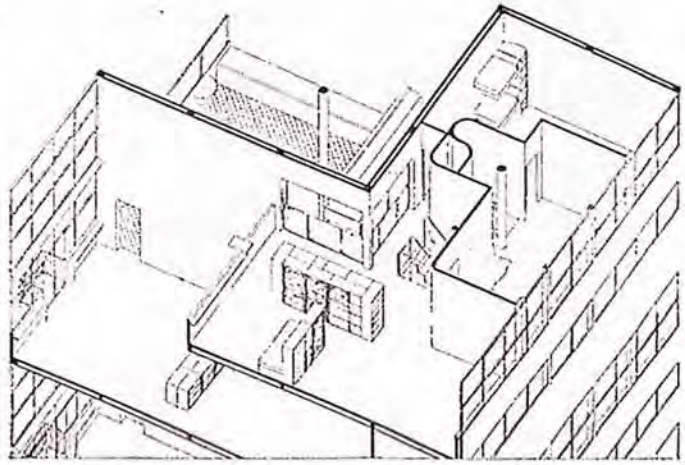
LE CORBUSIER'S CONTEMPORARY CITY
CELLULAR SYSTEM





A. *Hall.*
E. *The main staircase, lifts, goods lift.*
C. *Corridors on to which the "villas" open.*
VJ. *A "hanging garden."*
VS. *A living-room.*
N. *Pavement and stairs giving access to the hall.*
M. *Roadway raised on piles for light traffic.*
P. *Roadways at ground level for heavy traffic.*
Z. *Subterranean passage leading to the enclosed parks or*
R. *Internal parks or gardens.*
S. *Solaria (under "S" one of the service stairs is seen).*

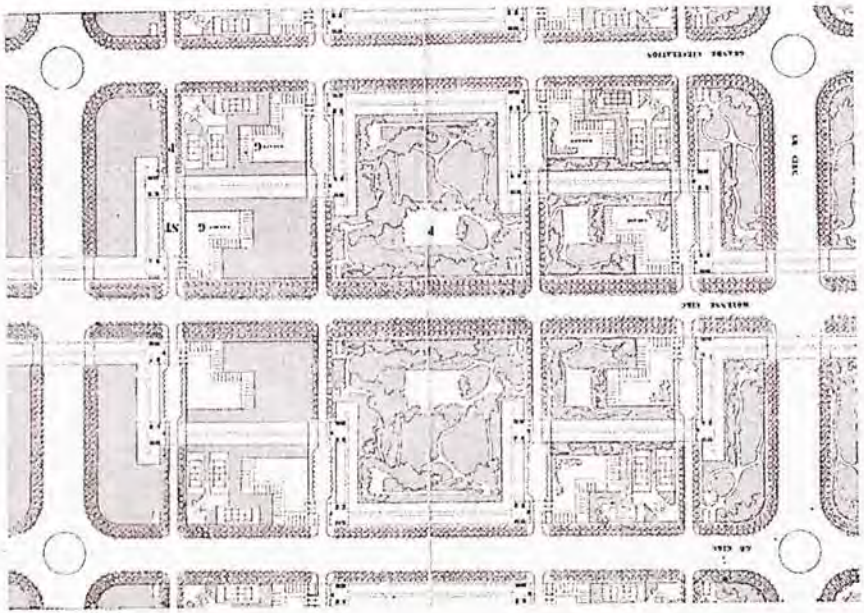


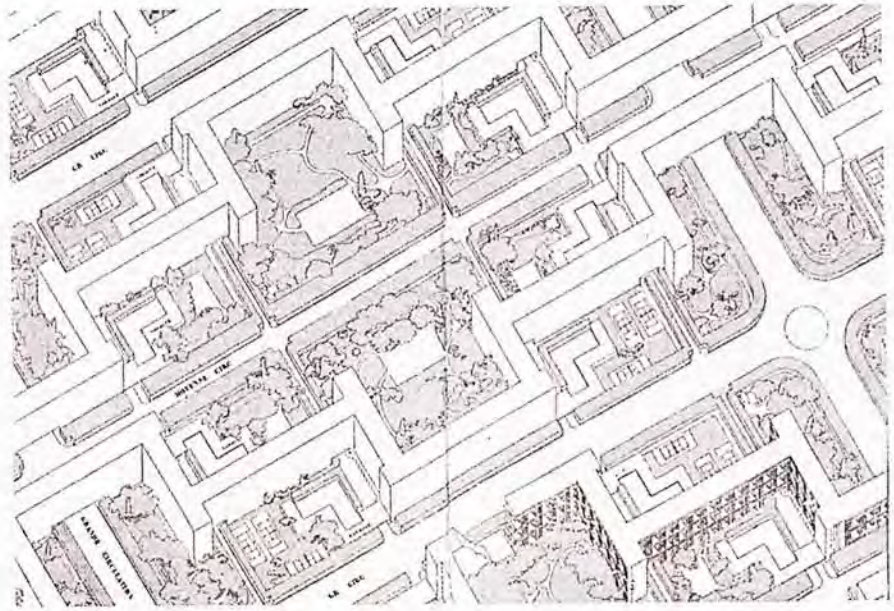


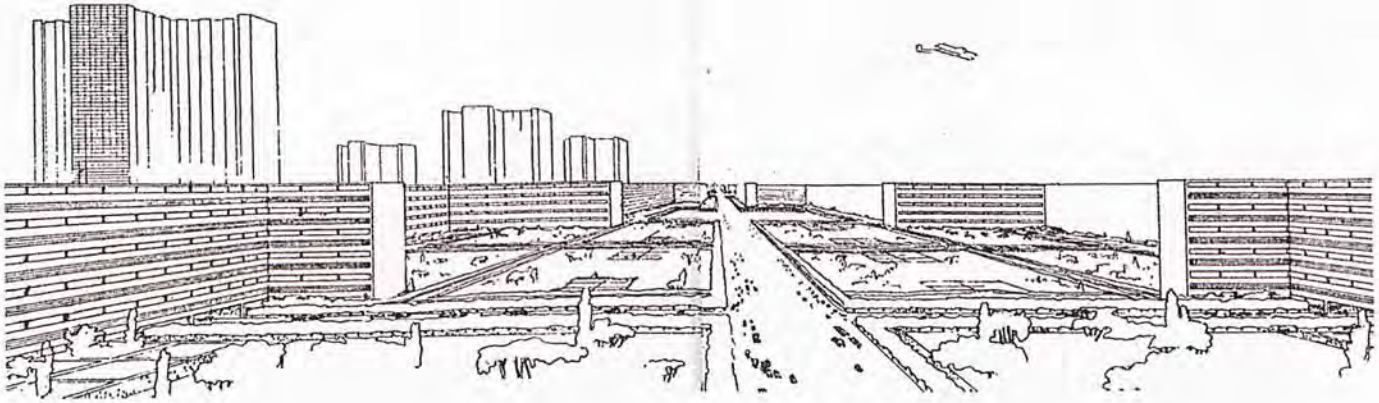
The residential blocks on the cellular system has around 120 inhabitants. The buildings on the cellular principle have hanging gardens, looking on to immense parks with no internal wells. These are service-flats of the most modern kind.

The building height is roughly 110 feet above ground level. The restricted floor to floot unite in present-day facade is about 11 feet; this is increased to nearly 20 feet, resulting in a nobler scale altogether in the architecture of the street.

SETBACKS







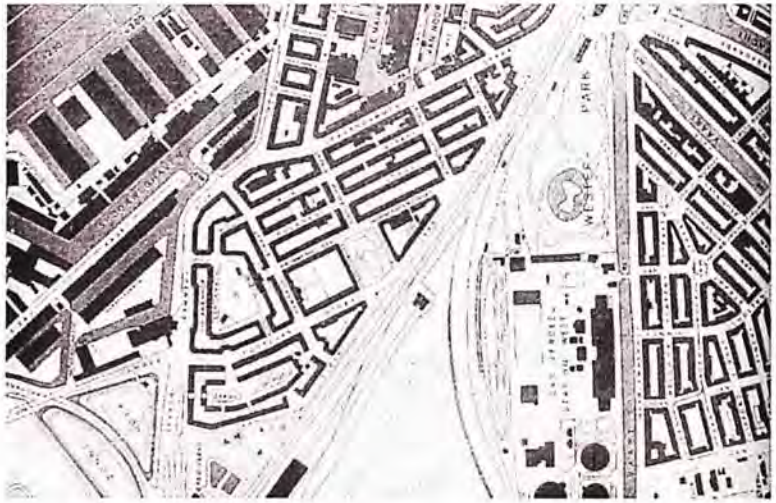
In this housing scheme with set-backs, the buildings are six double storeys in beight. The residential blocks with set-backs have 120 inhabitants to the acre. These are the luxury dwellings with no internal wells: the flats looking on either side on to immense parks.

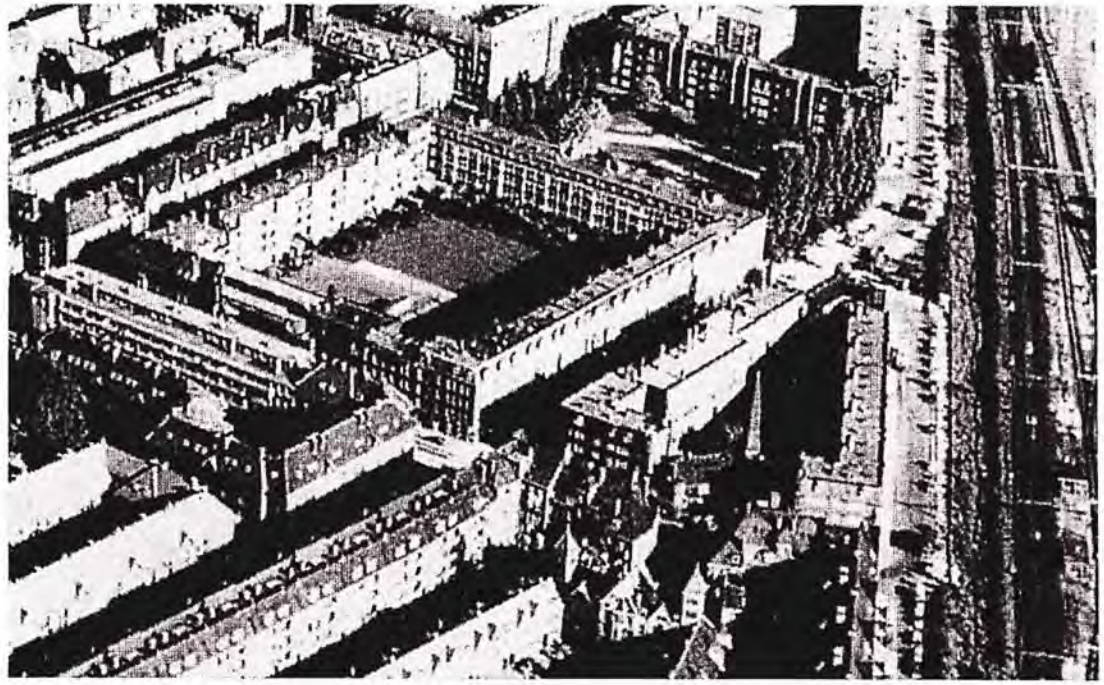
The set-backs supply an architectural motive which takes us far from the corrido-street. Every window of every room (and that on both frontages) looks on to open spaces.

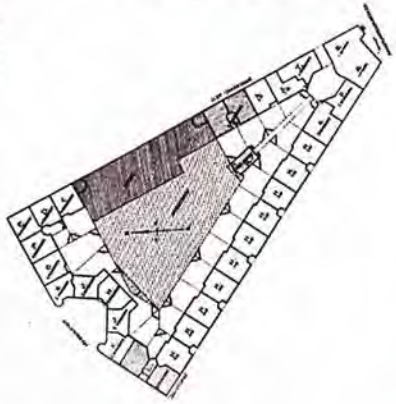
MASS HOUSING IN EUROPE

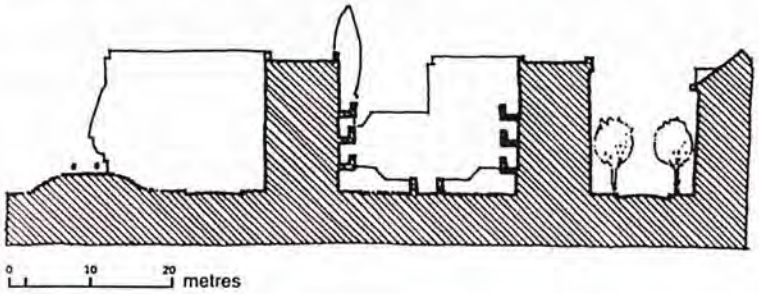
HOUSING BLOCK WITH POST OFFICE, OOSTZAANSTRAAT, HEMBRUGSTRAAT, AMSTERDAM (1917)

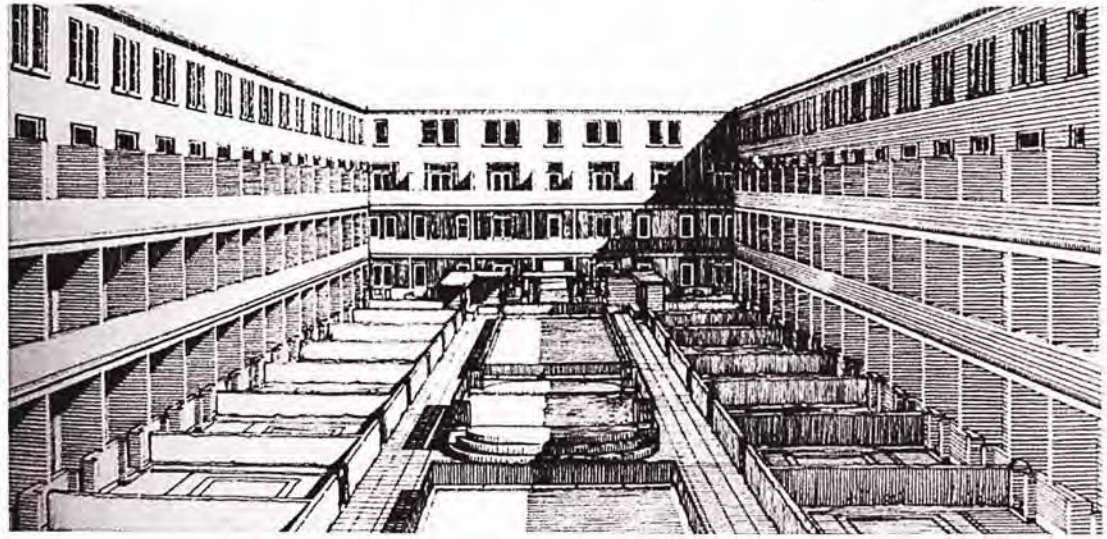
M. DE KLERK



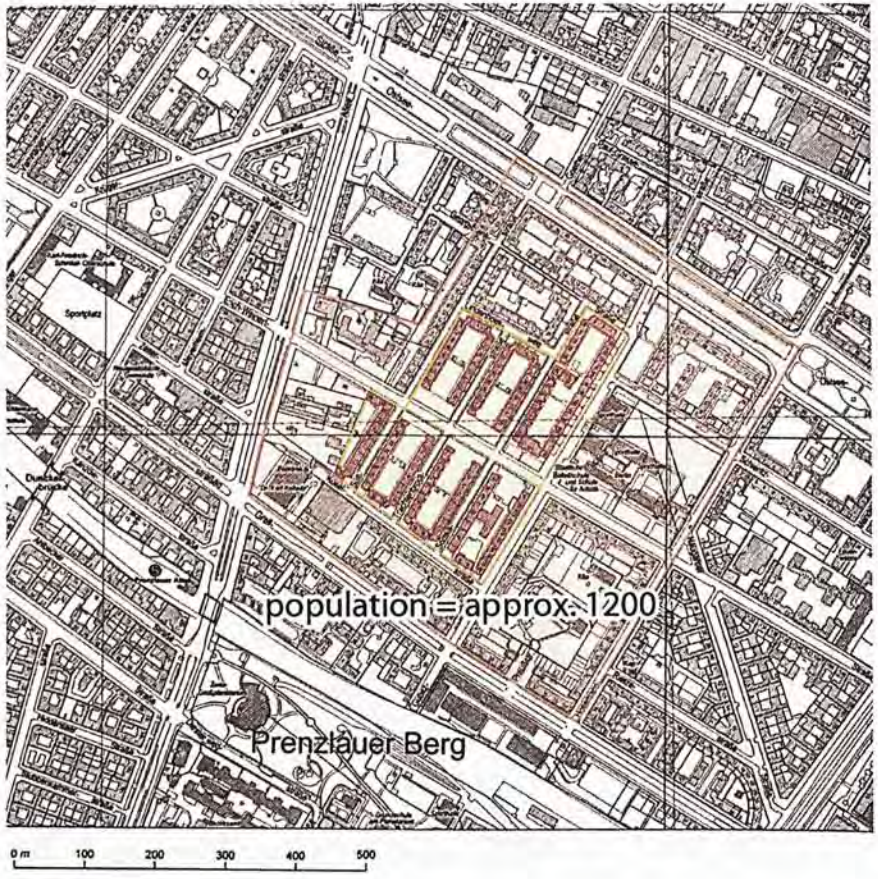




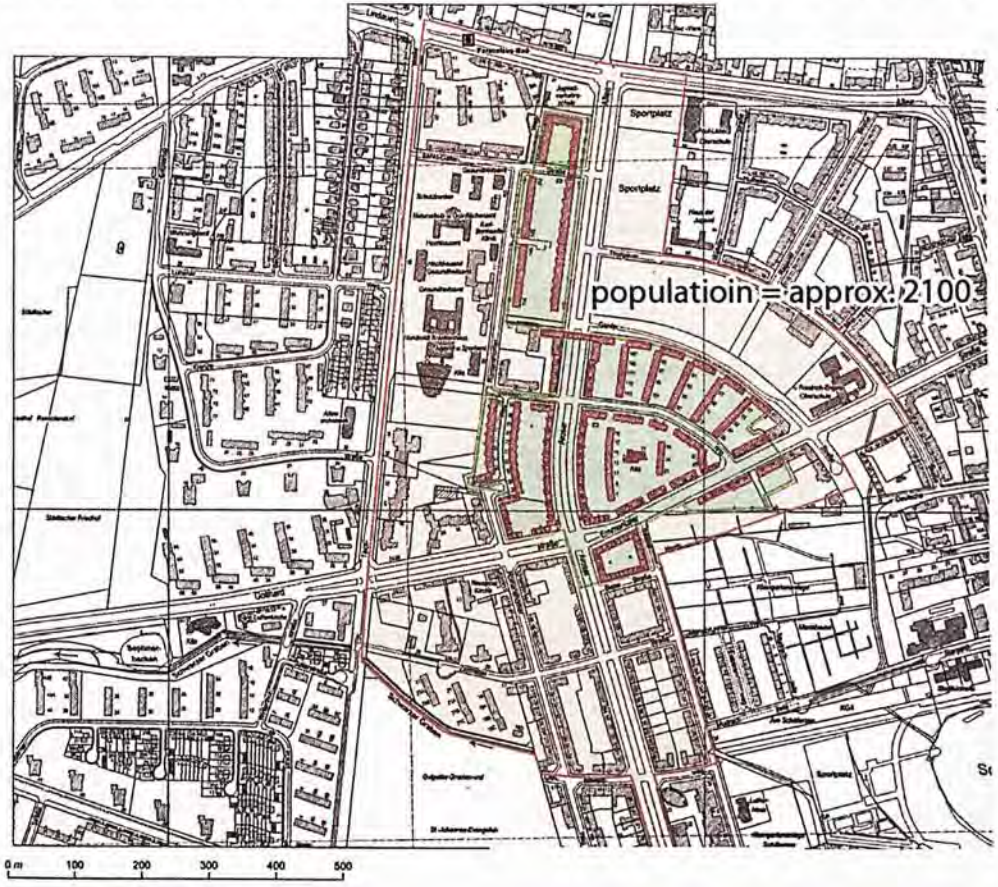




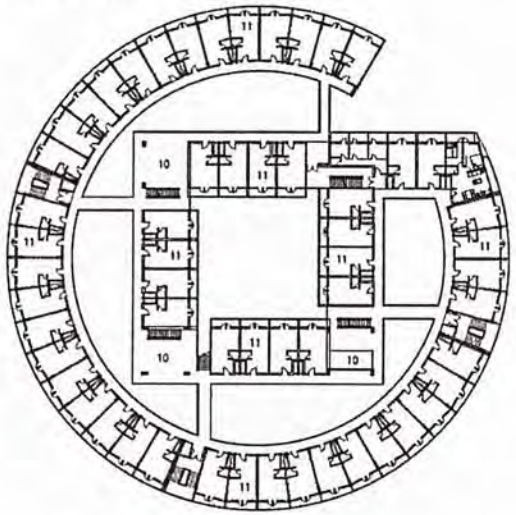
CARLLEGIEN ESTATE, BERLIN (1930)
BRUNO TAUT & FRANZ HILLINGER

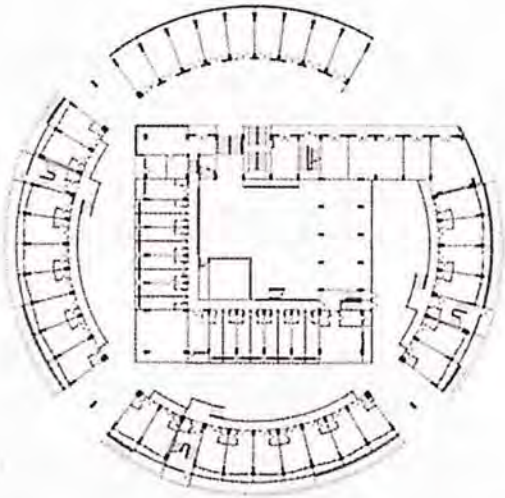


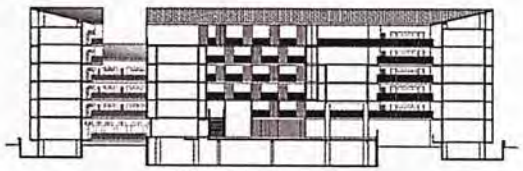
WHITE CITY, BERLIN (1931)
OTTO RUDOLF SALVISBERG, BRUNO AHREDS & WILHELM BUNING

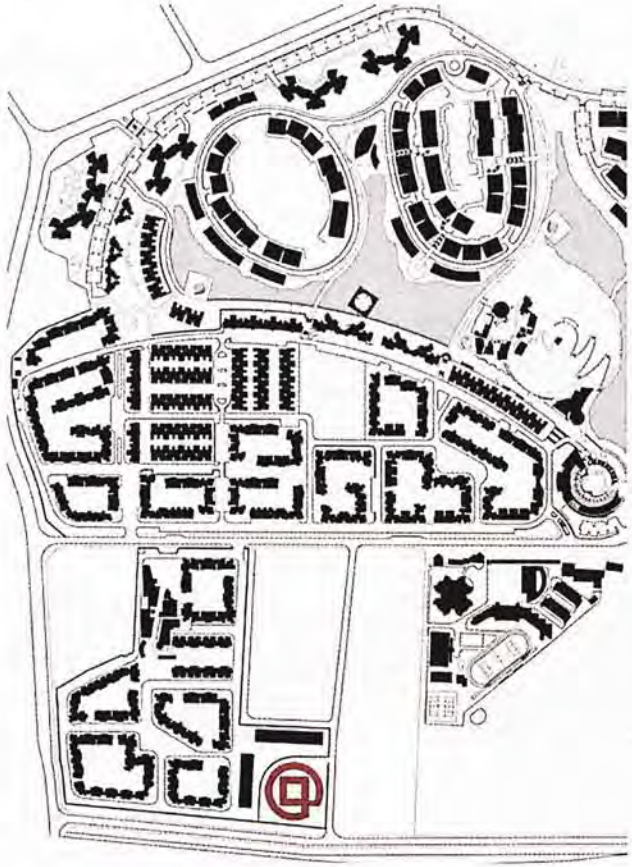


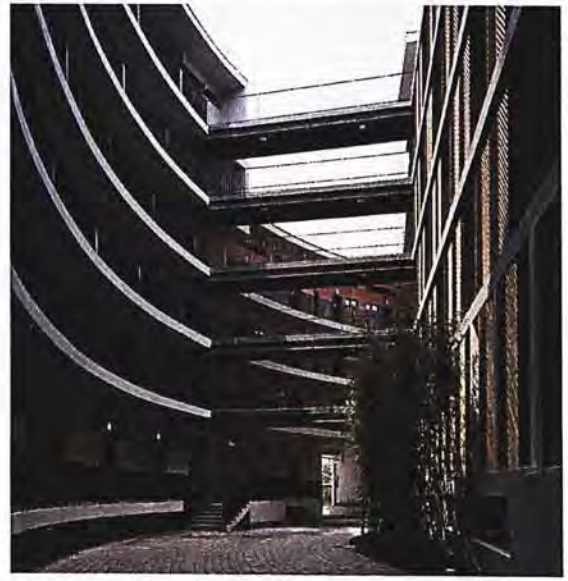
MASS HOUSING IN SHENZHEN
URBAN-TULOU, GUaNGDONG NANHAI (2008)
URBANUS







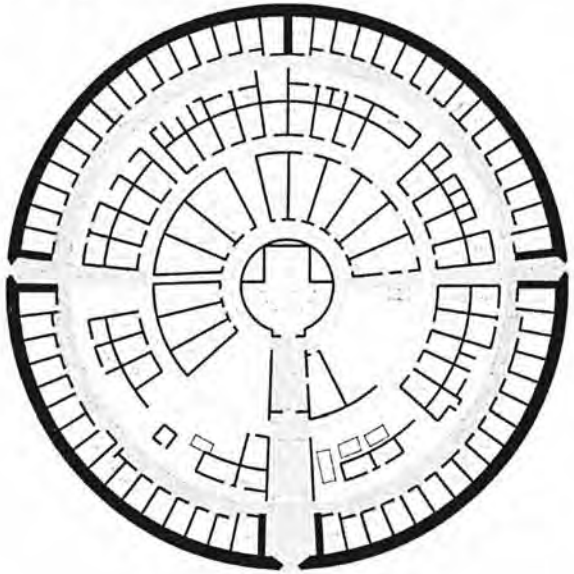


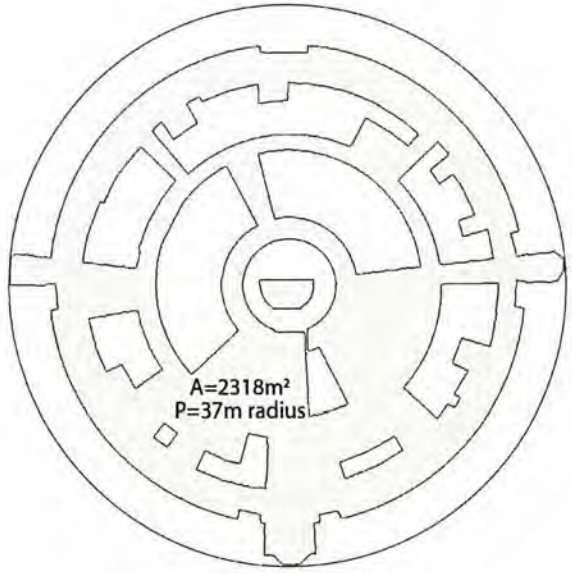


COURTYARD HOUSE STUDY

PLAN	COURTYARD(S), AREA (A) & PROPORTION (P)	HEIGHT OF COURTYARD & ASPECT RATIO (AR) (AREA / HEIGHT²)

SHING KAI LOU, FUJIAN (1709)

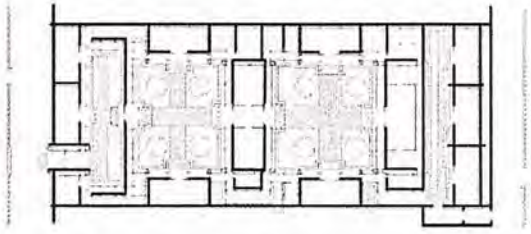


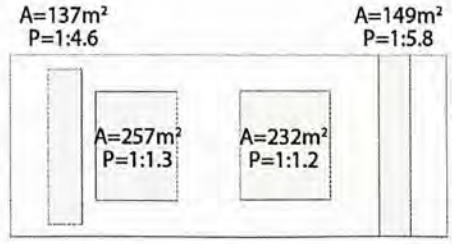


no. of family = 57

20m (4 storeys)
AR = 5.8

CHINESE COURTYARD HOUSE





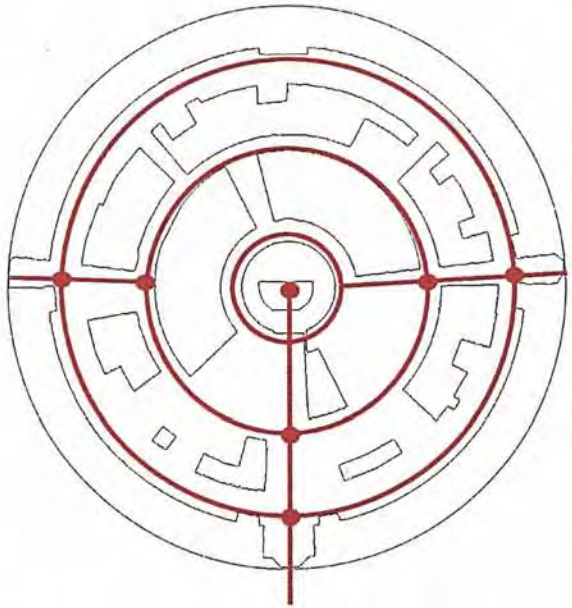
no. of family = 1

5m (storeys)
AR = 5.5 | 10.3 | 9.3 | 6.0

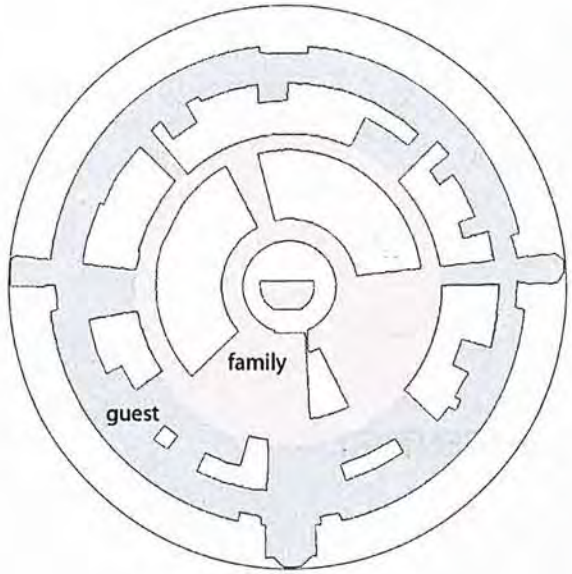
ROUTE TO
COURTYARD

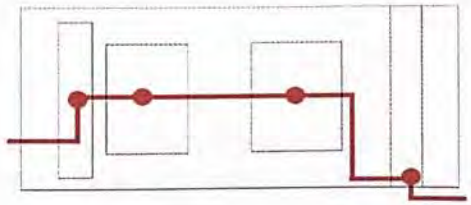
TARGET GROUP & PRIVACY

0 10 20 50m

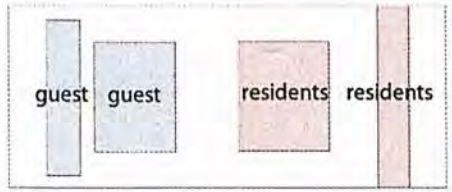


direct



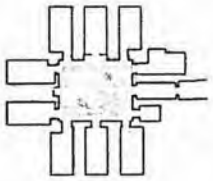


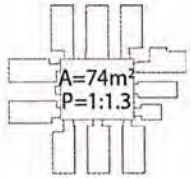
in sequence

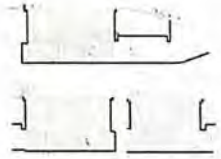


PLAN	COURTYARD(S), AREA (A) & PROPORTION (P)	HEIGHT OF COURTYARD & ASPECT RATIO (AR) (AREA / HEIGHT^2)

COURT CAVE HOUSE, HENAN



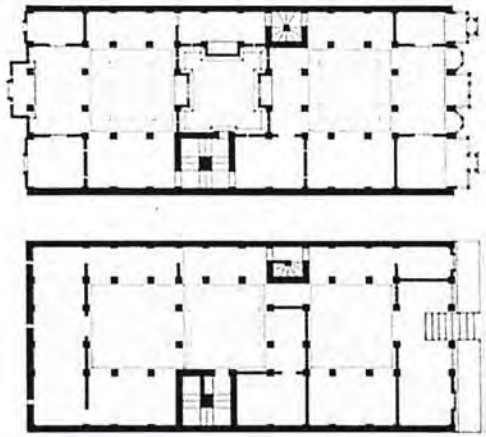


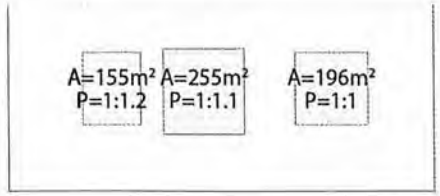


7m (1 storey)
AR = 1.5

no. of family = 1

CITY MANSION, HAISALMER, INDIA (15TH CENTURY)





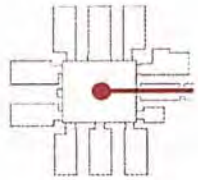
3.5 (1 storey) & 11m (3 storeys)
AR = 12.7 | 2.1 | 16

no. of family = 1

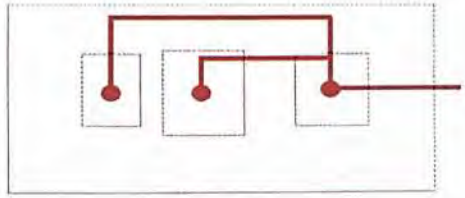
ROUTE TO
COURTYARD

TARGET GROUP & PRIVACY

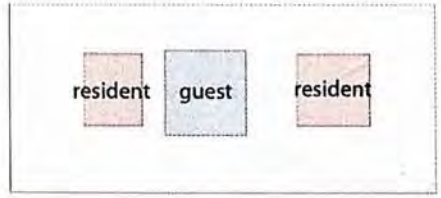
0 10 20 50m



direct

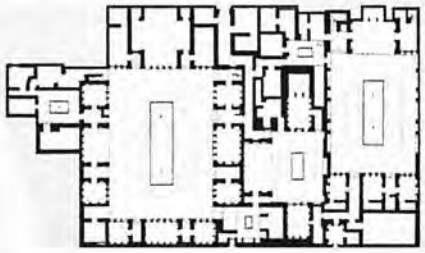


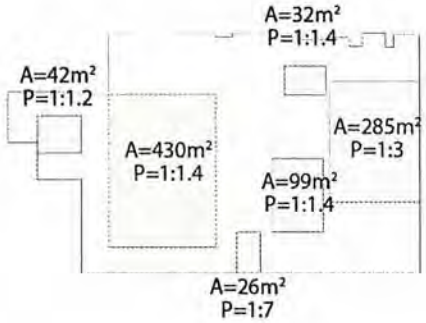
branch
(horizontally & vertically)

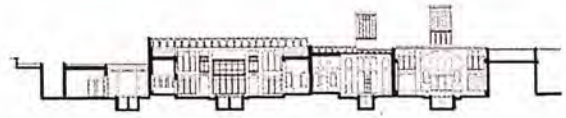


PLAN	COURTYARD(S), AREA (A) & PROPORTION (P)	HEIGHT OF COURTYARD & ASPECT RATIO (AR) (AREA / HEIGHT²)

THE TALAIE HOUSE, YAZD, IRAN (LATE 18TH - EARLY 19TH CENTRY)



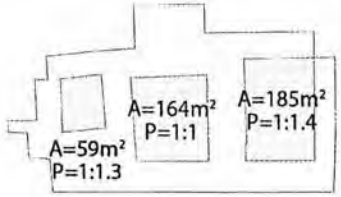


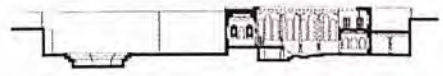


9m (2 storeys)
AR = 0.5 | 5.3 | 0.3 | 1.2 | 0.4 | 3.5

no. of family = 1

TURKISTANI HOUSE, BUKHARA (18TH TO 19TH CENTRY)





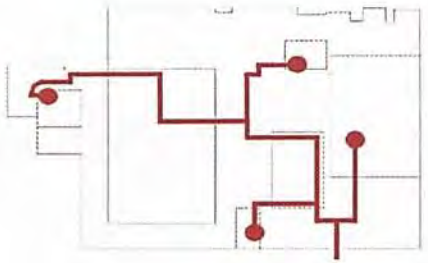
7.5m (2 storeys)
AR = 1.0 | 2.9 | 3.3

no. of family = 1

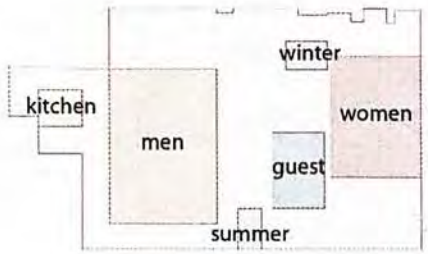
ROUTE TO
COURTYARD

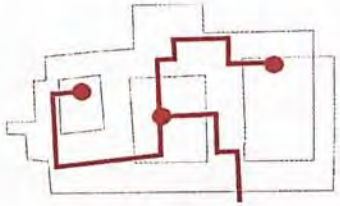
TARGET GROUP & PRIVACY

0 10 20 50m

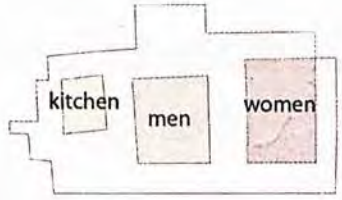


branch



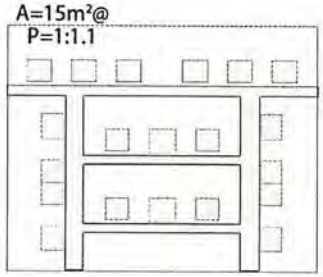


branch



PLAN	COURTYARD(S), AREA (A) & PROPORTION (P)	HEIGHT OF COURTYARD & ASPECT RATIO (AR) (AREA / HEIGHT²)

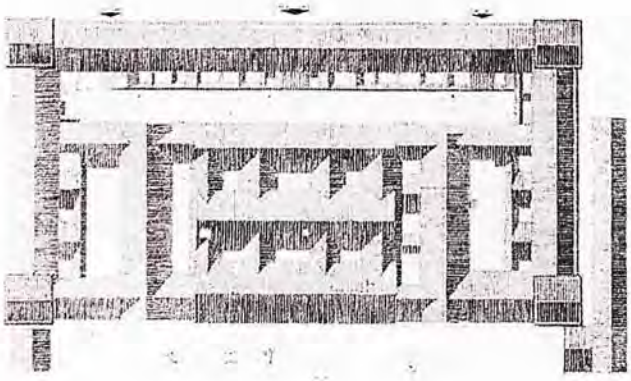
SAM TUNG UK, TSUEN WAN

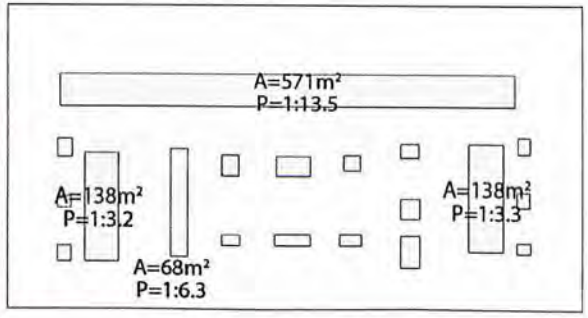


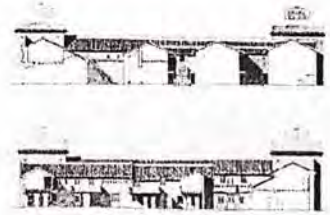
no. of family = 18

5m (1 storey)
AR = 0.6

TSANG TAI UK, SHATIN (1867)







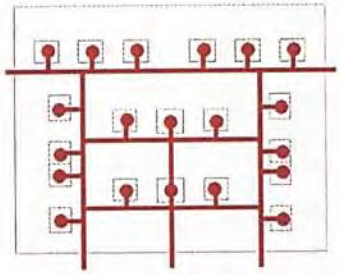
no. of family = 99

9m (2 storeys)
AR = 7.0 |
1.7 | 0.8 | 1.7

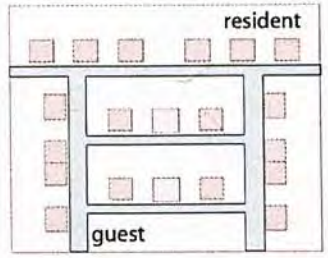
ROUTE TO
COURTYARD

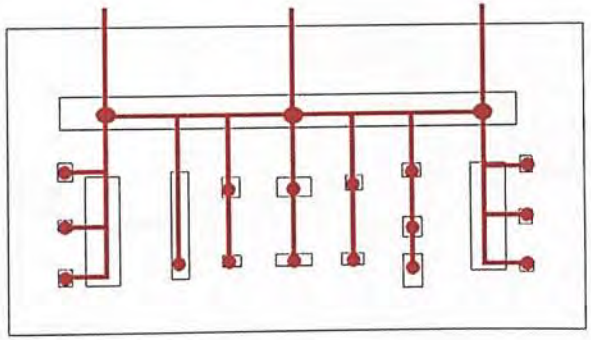
TARGET GROUP & PRIVACY

0 10 20 50m

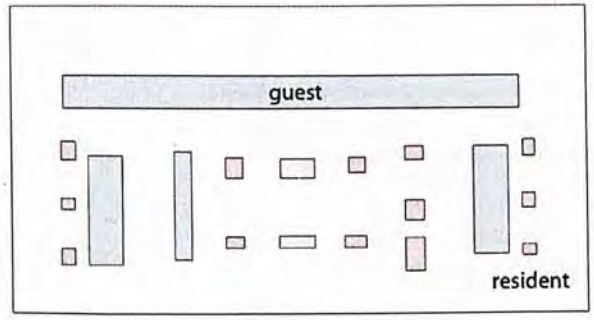


network



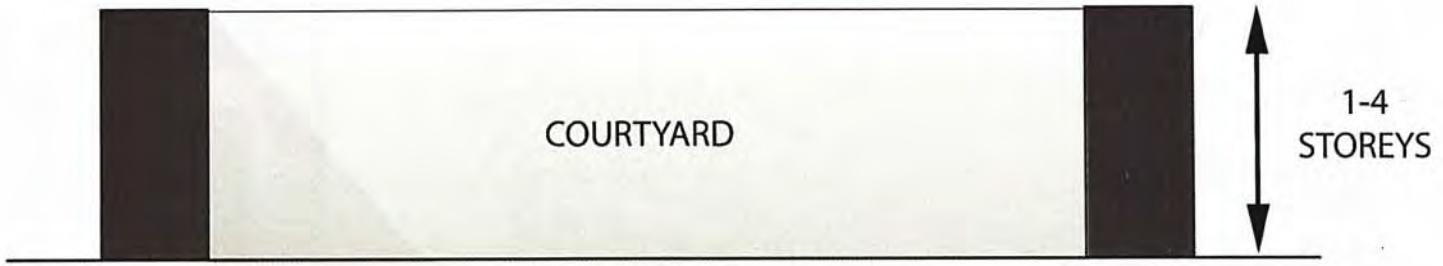


network



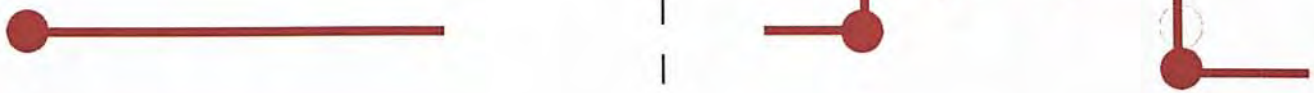
SUMMARY

HEIGHT



CIRCULATION

SIMPLE

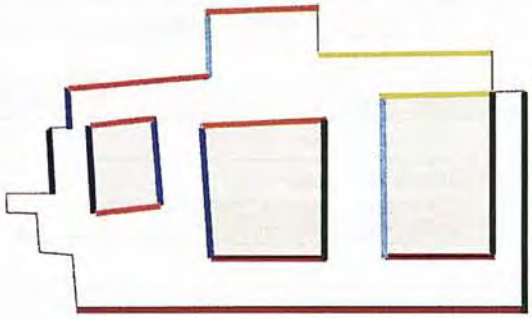


DIRECT

IN SEQUENCE

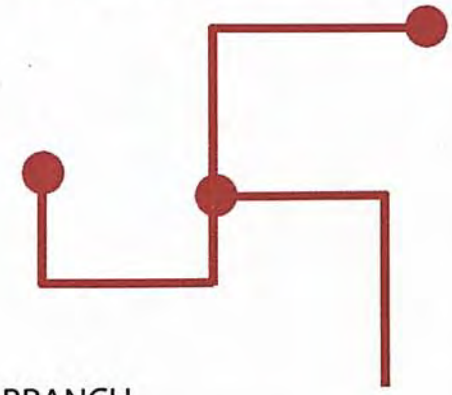
SHAPE

VARIOUS SHAPE
- Rectangular
- Circular
- Irregular - align to the profile or site

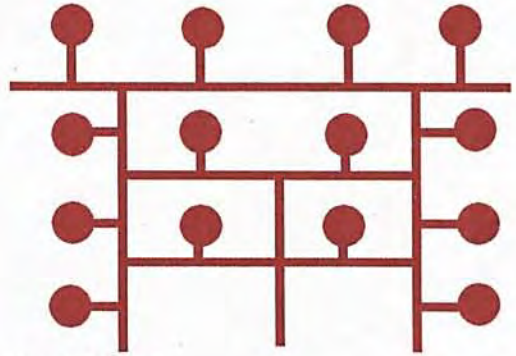


ARCADE

COMPLEX



BRANCH

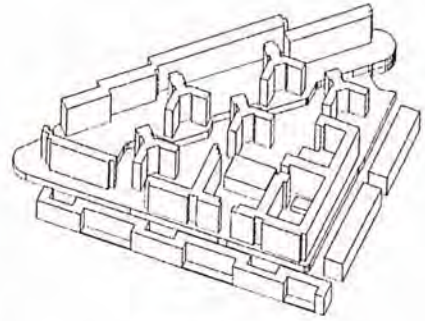


NETWORK

COURTYARDS IN MASS HOUSING

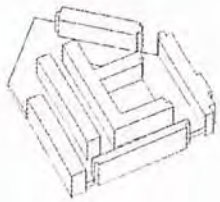
TARGET : PUBLIC HOUSING
DISTRICT : SHAM SHUI PO
TOTAL NO. OF PUBLIC ESTATE : 15
NO. OF SELECTED PUBLIC ESTATES : 5
NO. OF SELECT COURTYARDS : 7
COMPLETION PERIOD OF THE SELECTED ESTATES : 1960 - 1984

HOUING ESTATES	YEAR
So Uk Estate	1960
Tai Hang Sai Estate	1965
Pak Tin Estate	1975
Shek Kip Mei Estate	1976
Nam Shan Estate	1977
Tai Hang Tung Estate	1980
Lai Kok Estate	1981
Chak On Estate	1983
Lee Cheng Uk Estate	1984
Nam Cheong Estate	1989
Lai On Estate	1993
Un Chau Estate	1998
Fortune Estate	2000
Fu Cheong Estate	2001
Hoi Lai Estate	2004

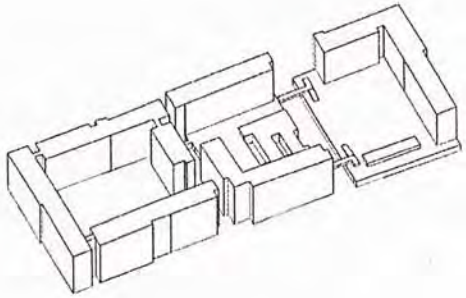


SO UK ESTATE (1960)

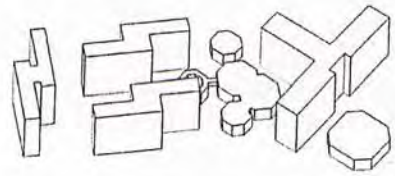
CIRTERIA FOR SELECTION							
Level Difference	Enclosed Courtyard	Courtyards with Commercial Activities	Podium	Slab Block with Single-loaded Corridor	Slab Block with Double-loaded Corridor	Tower	With Non-residential Buildings
X	X	X		X	X	X	X
X	X			X	X		
X	X	X	X		X	X	X
	X	X	X		X	X	X
X	X		X		X		X
	X				X	X	X
	X	X	X		X		
X	X				X		X
	X		X		X	X	X
	X				X		X
	X					X	
						X	X
						X	X
			X			X	
						X	X



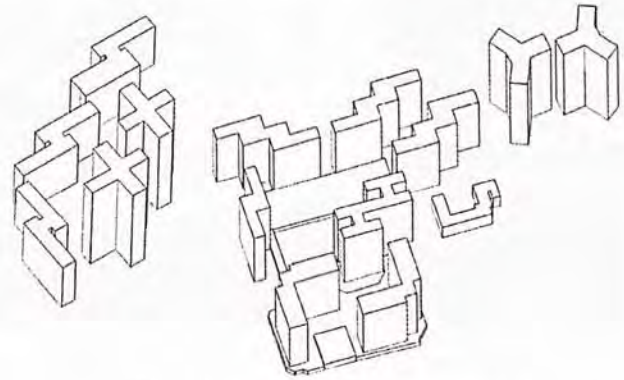
TAI HANG SAI ESTATE (1965)



SHEK KIP MEI ESTATE (1976)

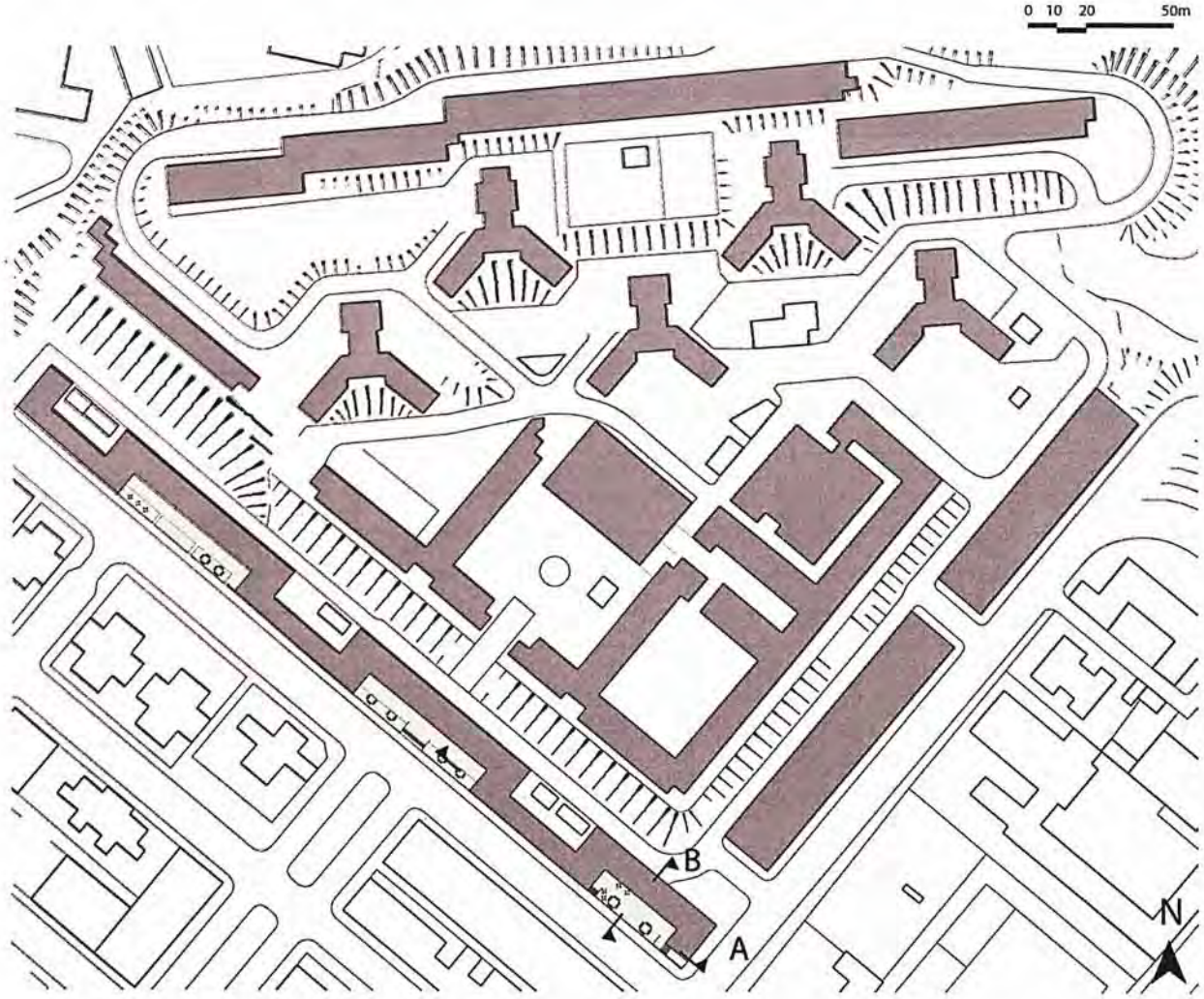


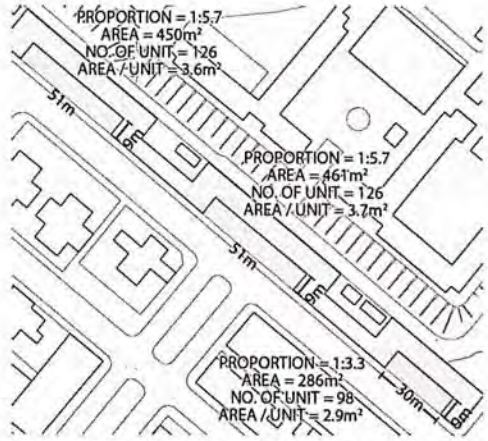
TAI HANG TUNG ESTATE (1980)



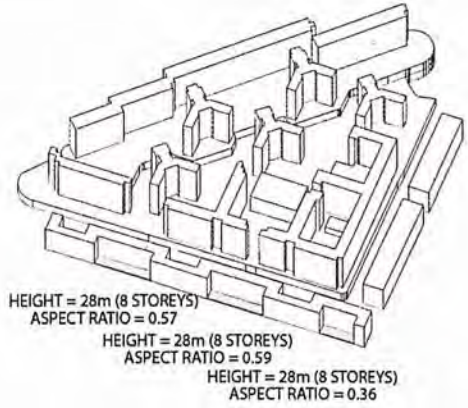
LEE CHENG UK ESTATE (1984)

SO UK ESTATE (1960)

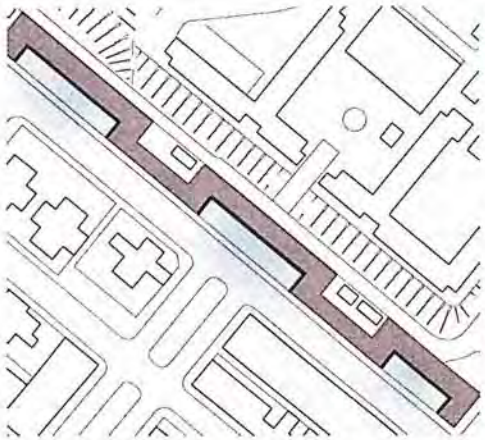


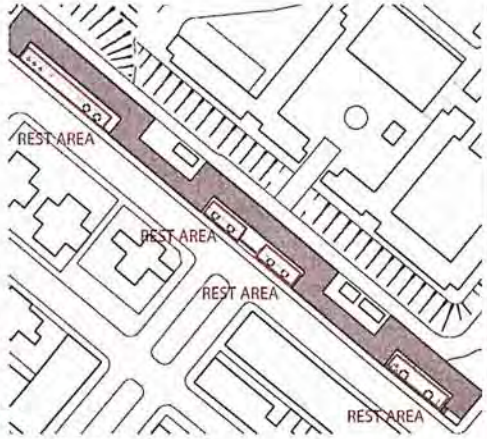


DIEMNSION, PROPORTION & NO. OF UNIT

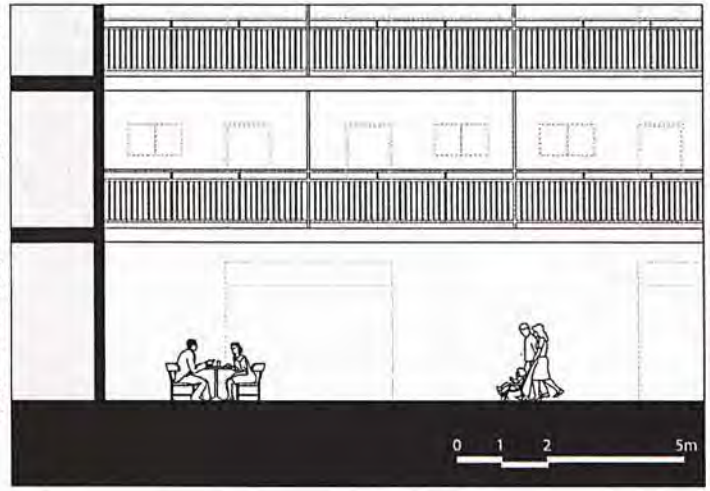


DEPTH & ASPECT RATIO (AREA / HEIGHT²)





NO. OF DIVISION(S) = 1-2

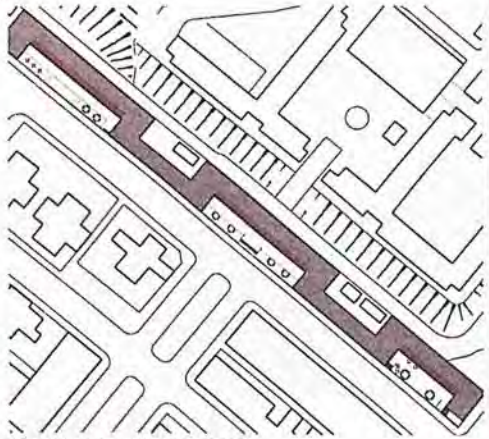


SECTION A SECTION B

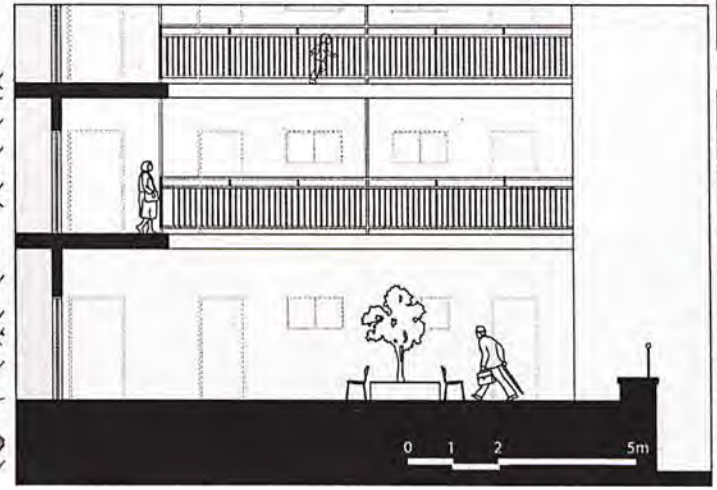
ENCLOSURE

- Enclosed by the budiling in "U" shape
- A platform to define the efge at the opening

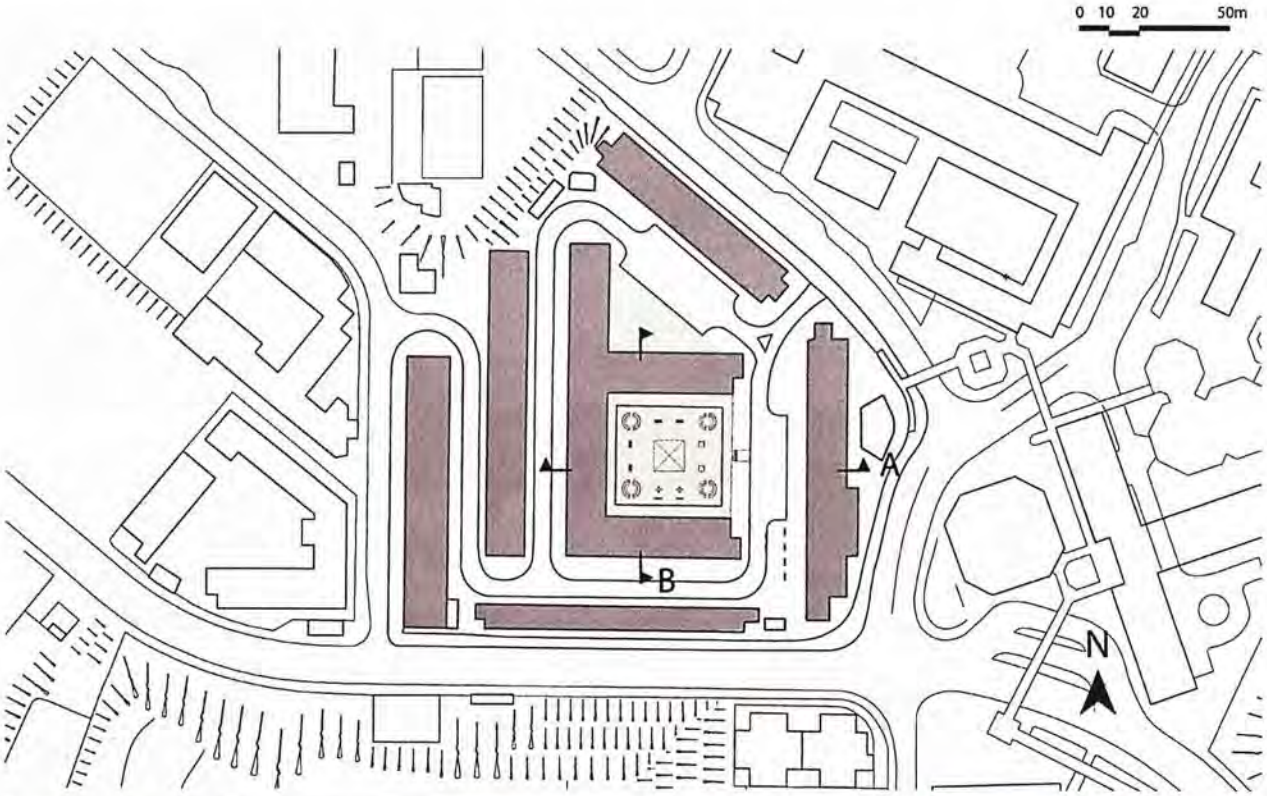
ACCESSBILITY

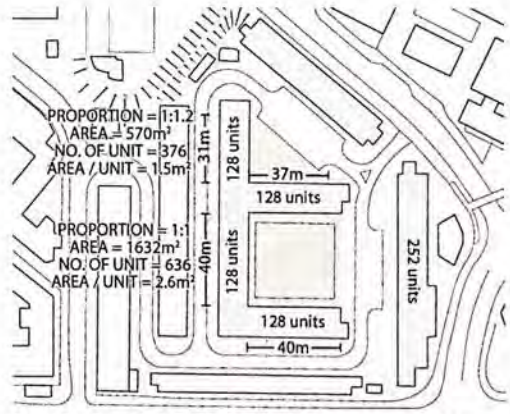


COVERED WALKWAY

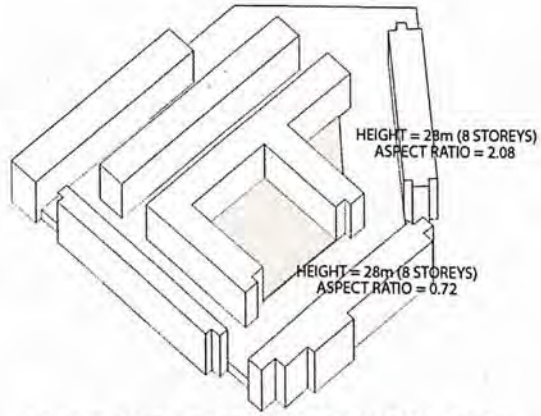


TAI HANG SAI ESTATE (1965)

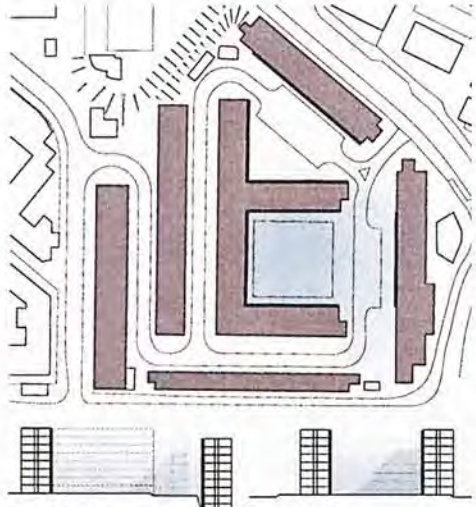




DIEMNSION, PROPORTION & NO. OF UNIT



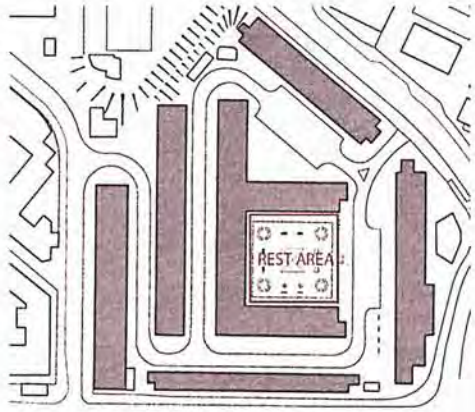
DEPTH & ASPECT RATIO (AREA / HEIGHT²)



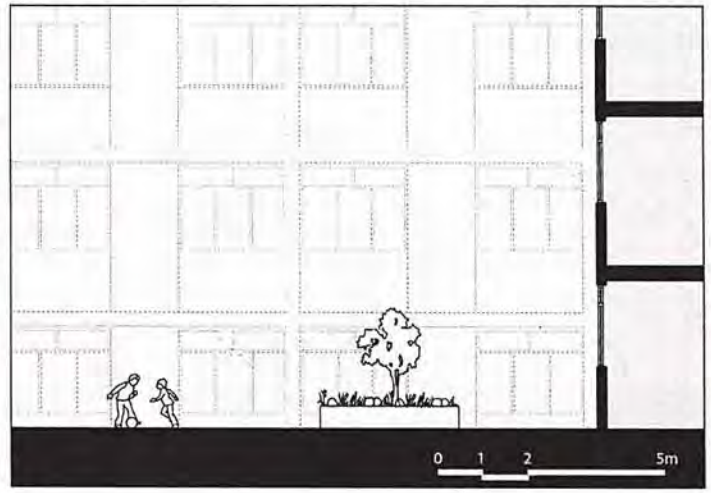
SECTION A SECTION B

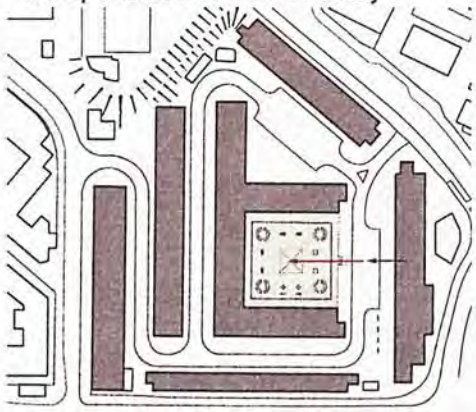
ENCLOSURE

- Bounded by the platform physically
- The open side is enclosed visually

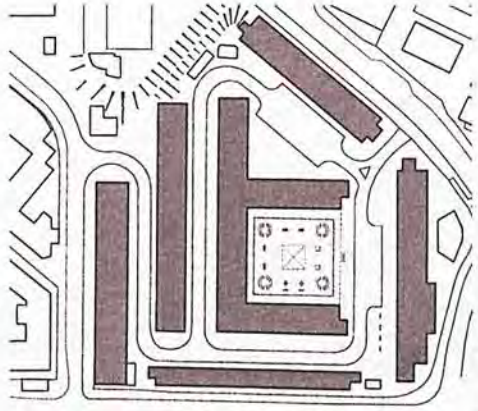


NO. OF DIVISION = 1

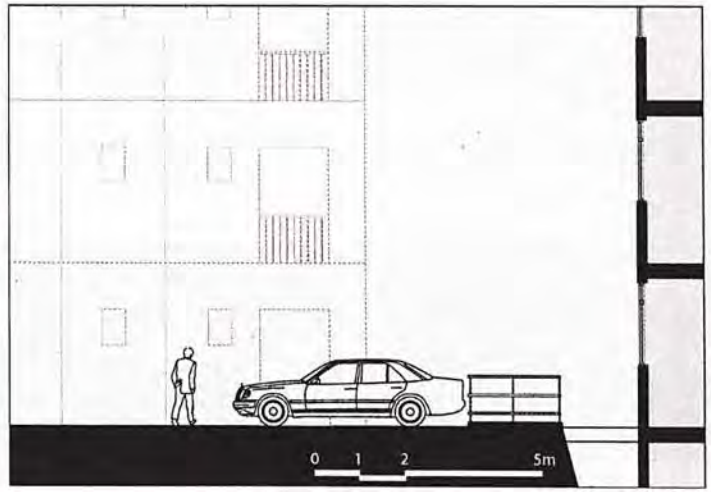


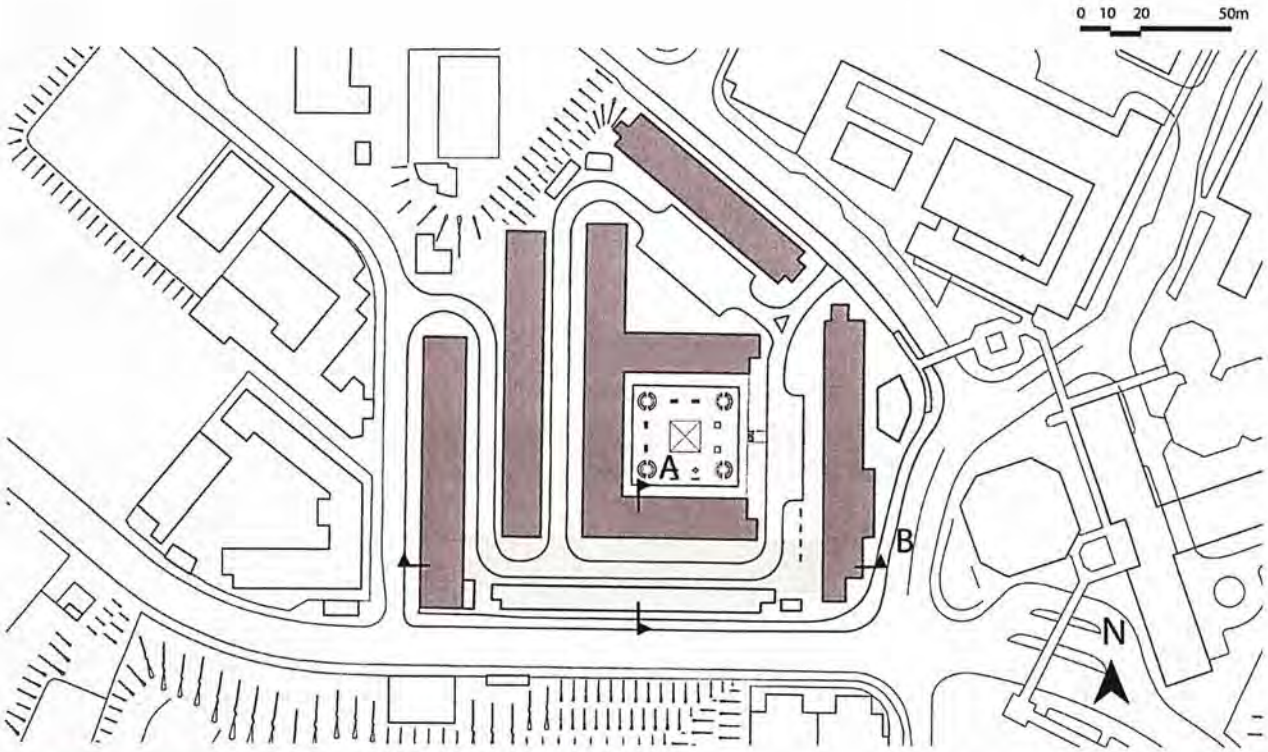


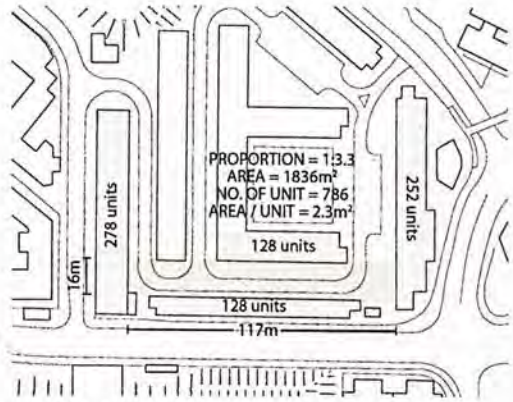
ACCESSBILITY



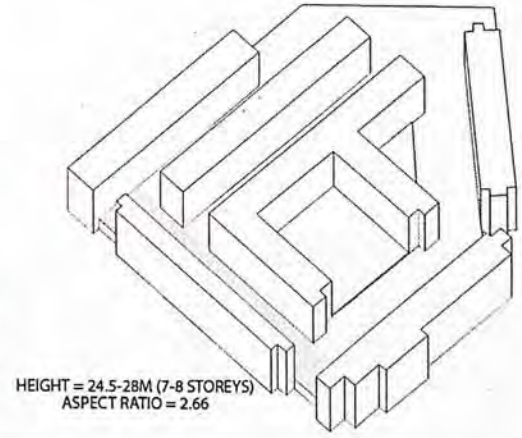
WITHOUT CANOPY



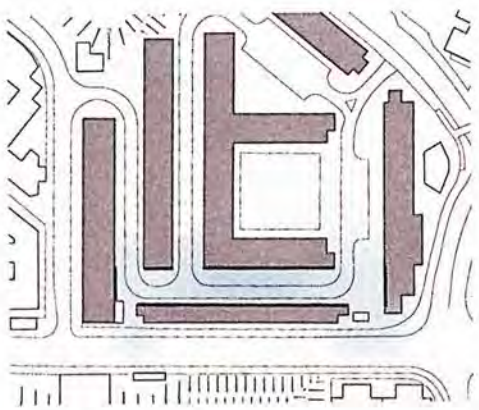


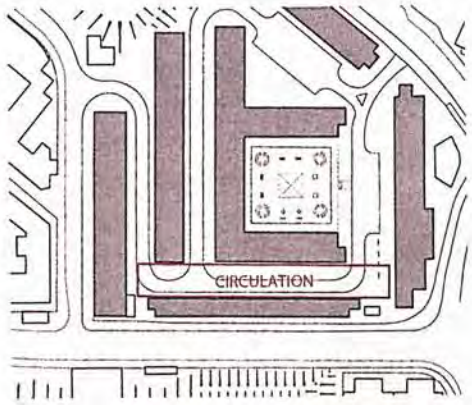


DIEMNSION, PROPORTION & NO. OF UNIT

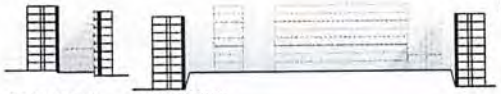


DEPTH & ASPECT RATIO (AREA / HEIGHT²)





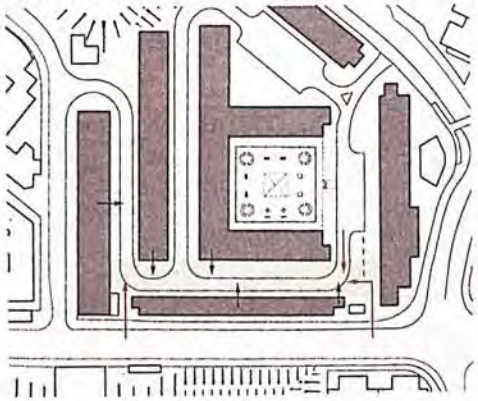
NO. OF DIVISION = 1



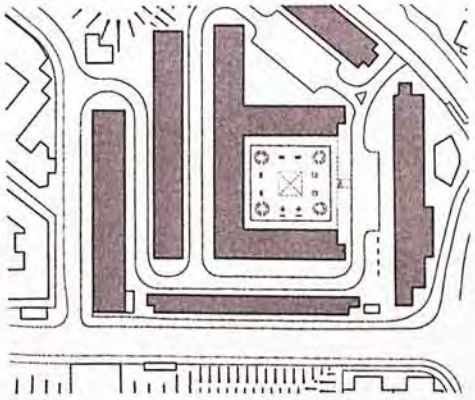
SECTION A SECTION B

ENCLOSURE

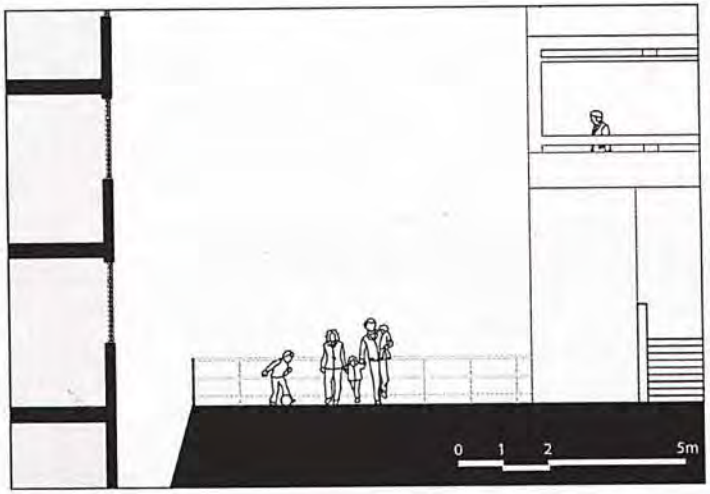
- Bounded by the podium physically
- Enclosed discountinously by visually

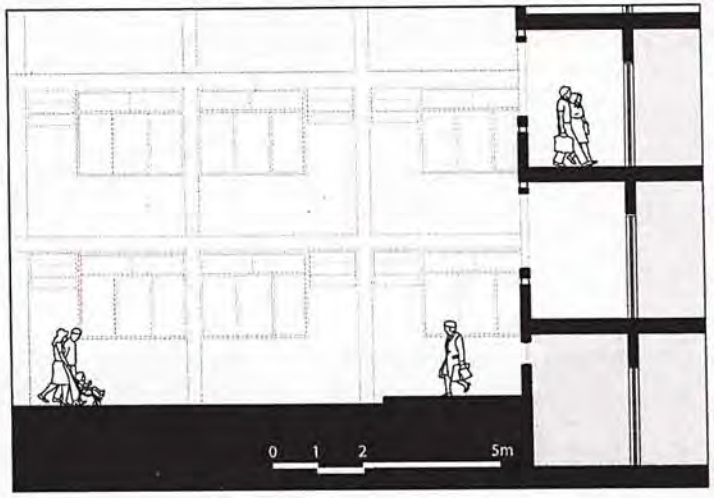


ACCESSBILITY

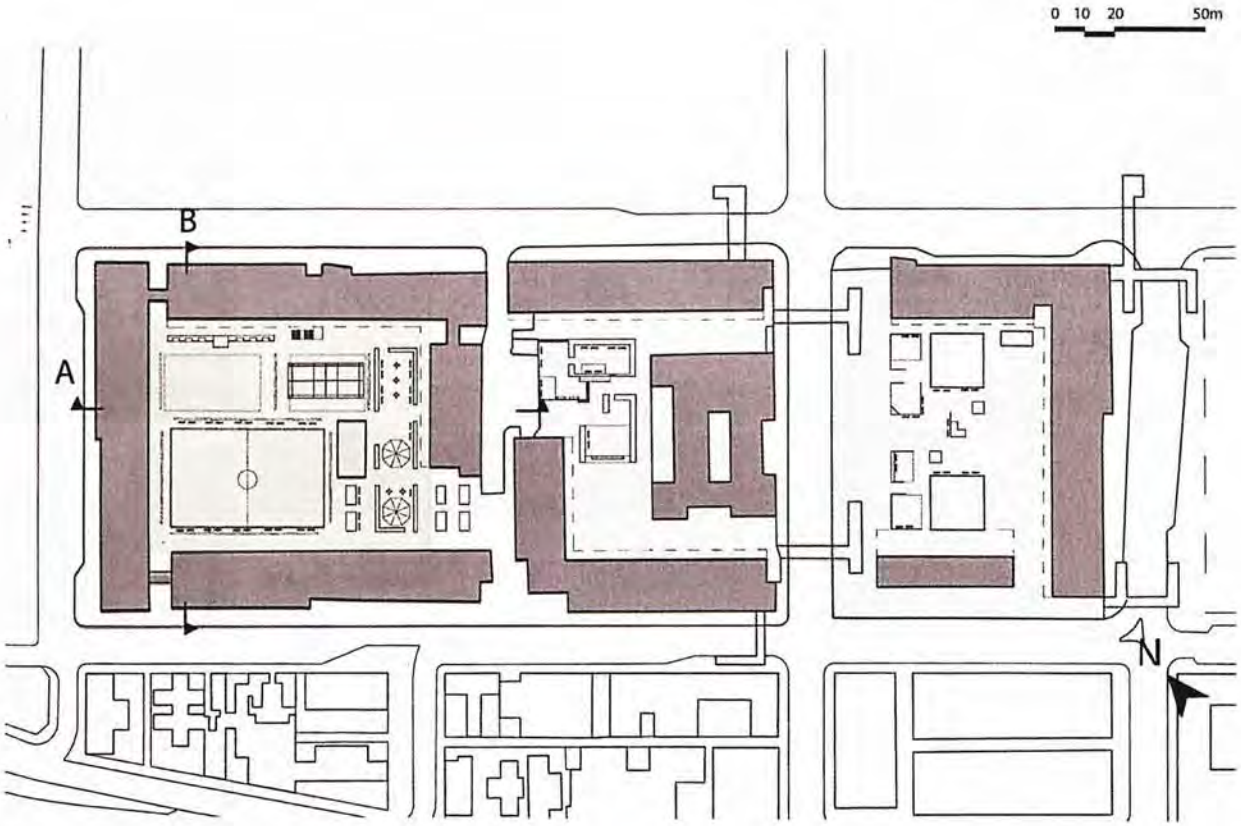


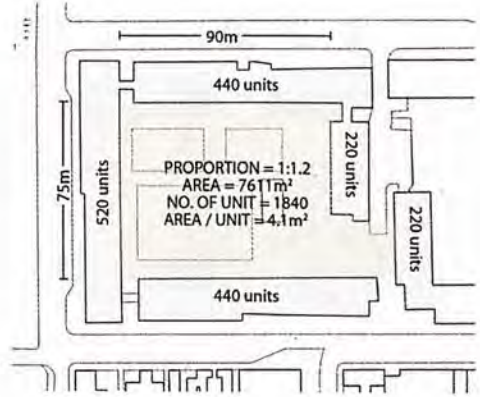
WITHOUT CANOPY



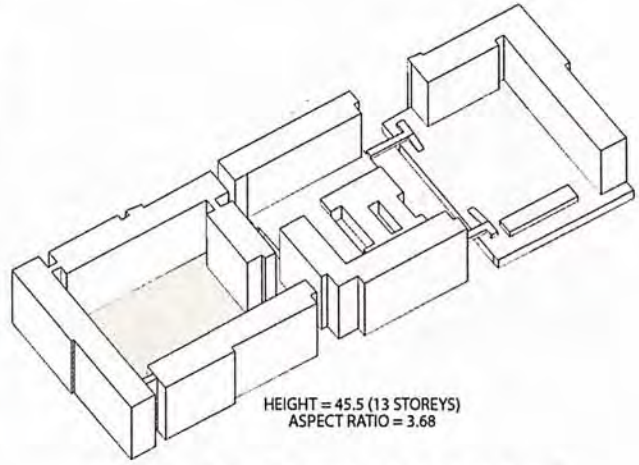


SHECK KIP MEI ESTATE (1976)

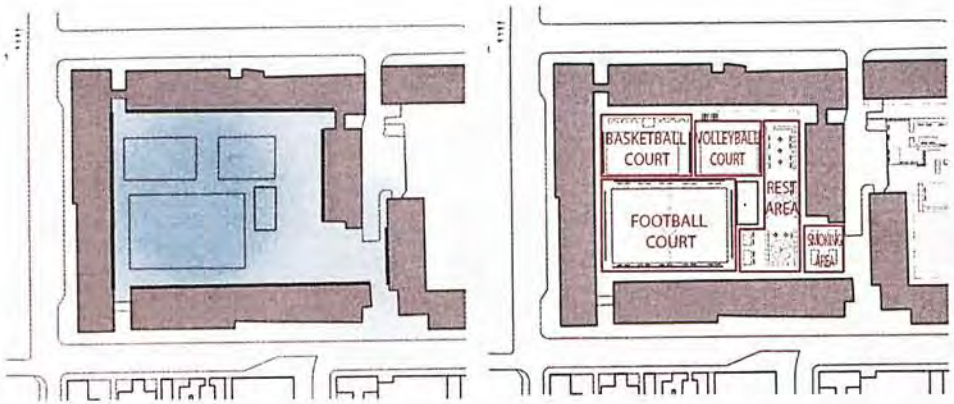




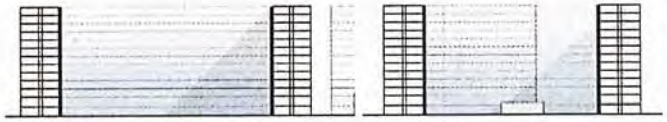
DIEMNSION, PROPORTION & NO. OF UNIT



DEPTH & ASPECT RATIO (AREA / HEIGHT²)



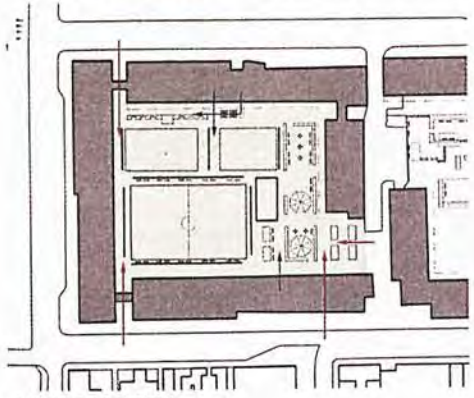
NO. OF DIVISIONS = 5



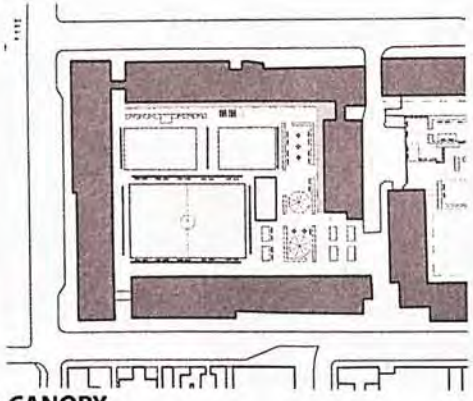
SECTION A SECTION B

ENCLOSURE

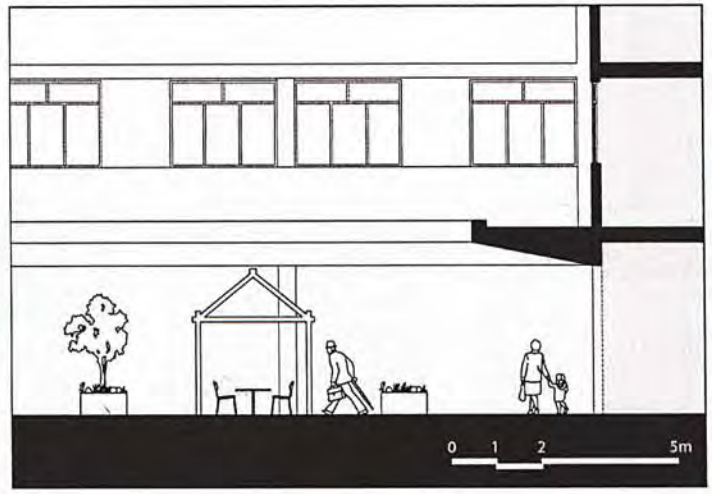
- Enclosed by the buildings totally
- An openning created by cutting and shifting

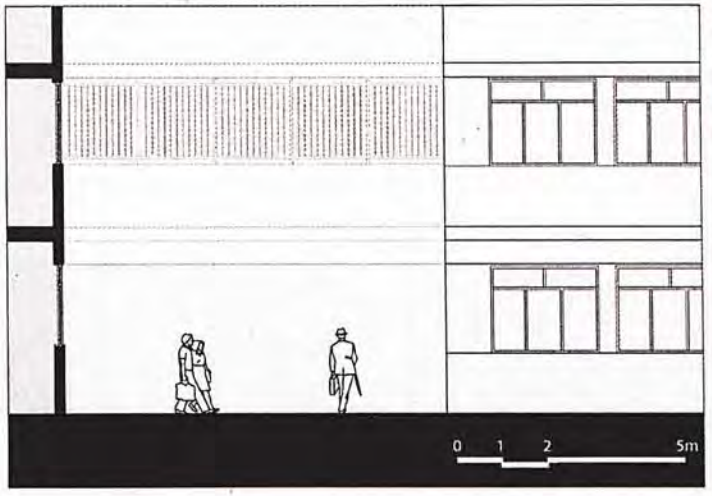


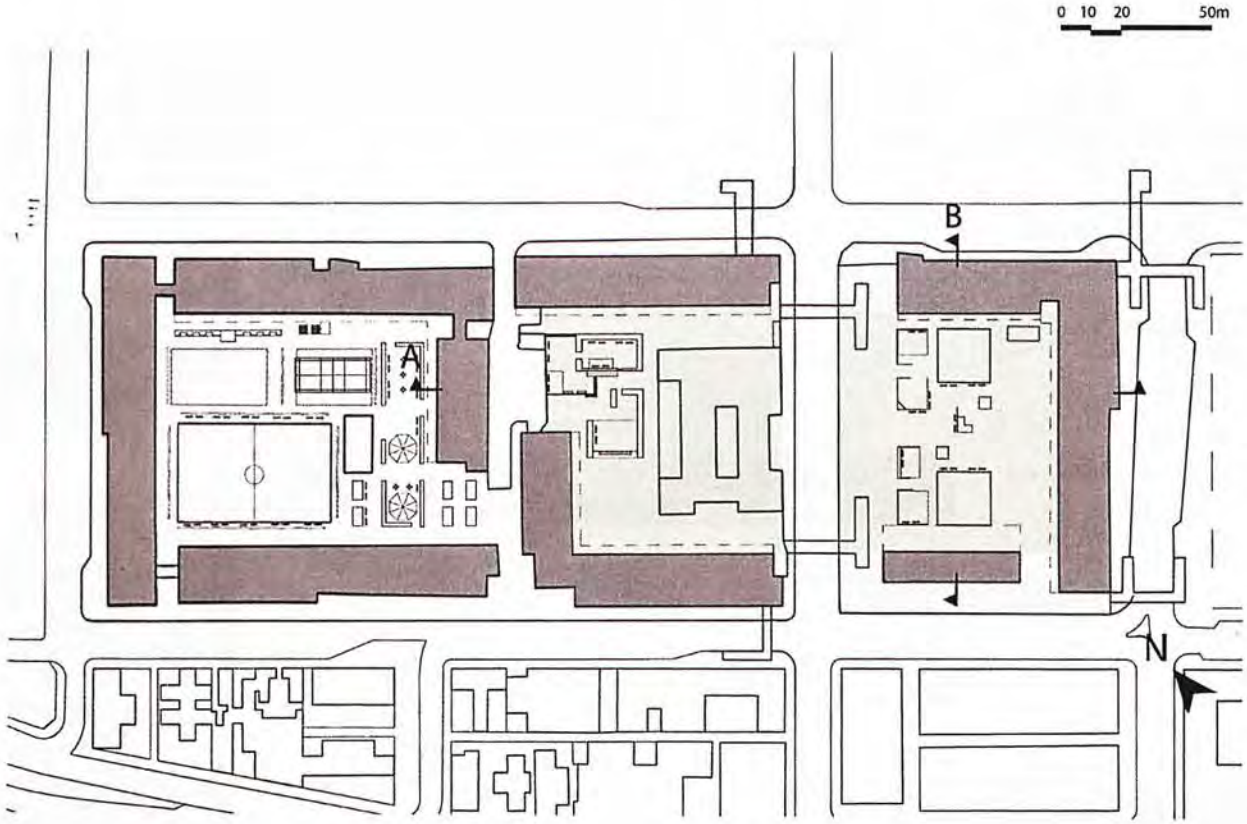
ACCESSBILITY

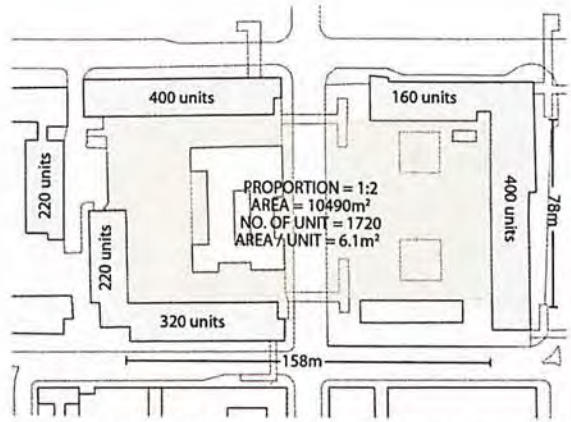


CANOPY

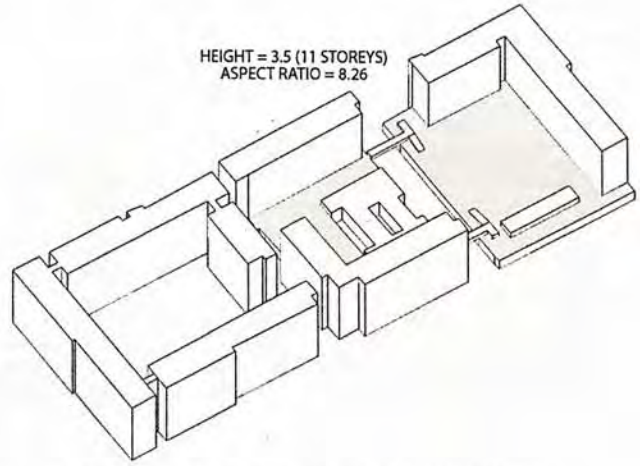




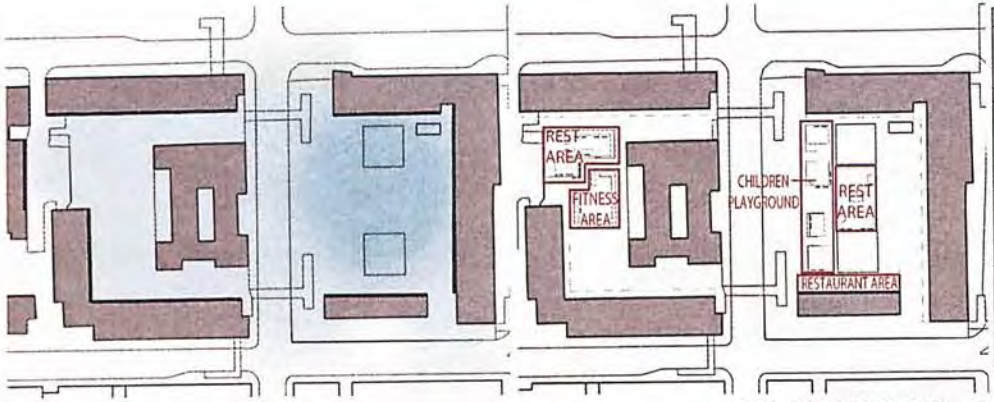




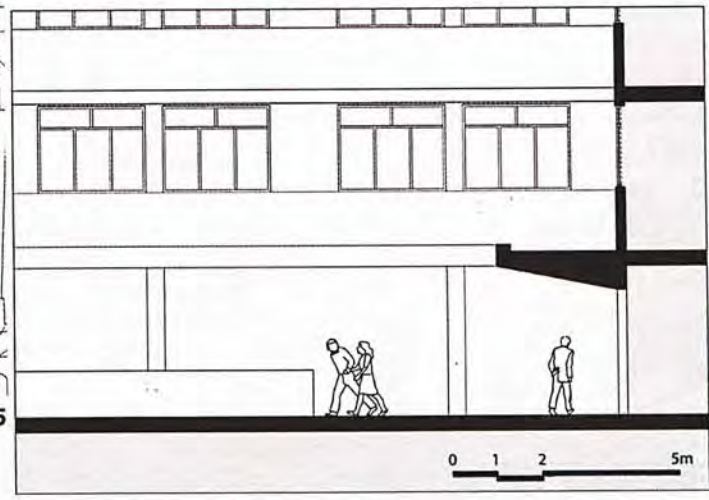
DIEMNSION, PROPORTION & NO. OF UNIT

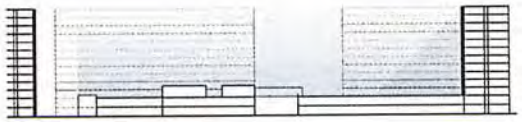


DEPTH & ASPECT RATIO (AREA / HEIGHT²)



NO. OF DIVISIONS = 5

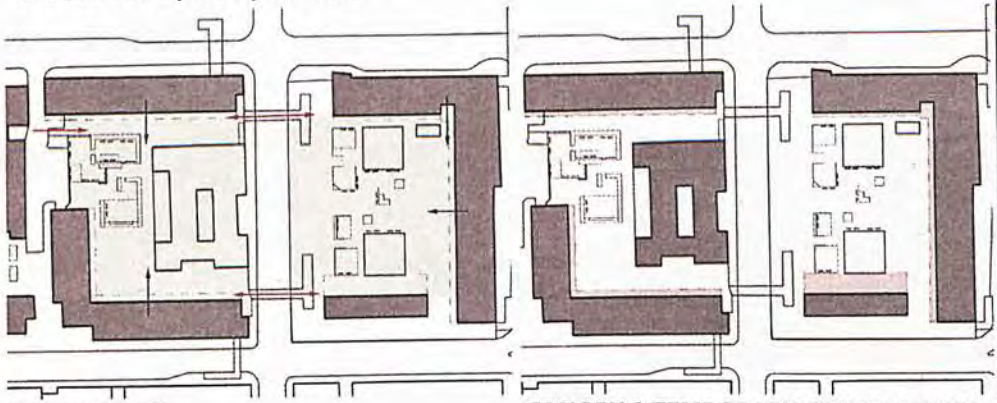




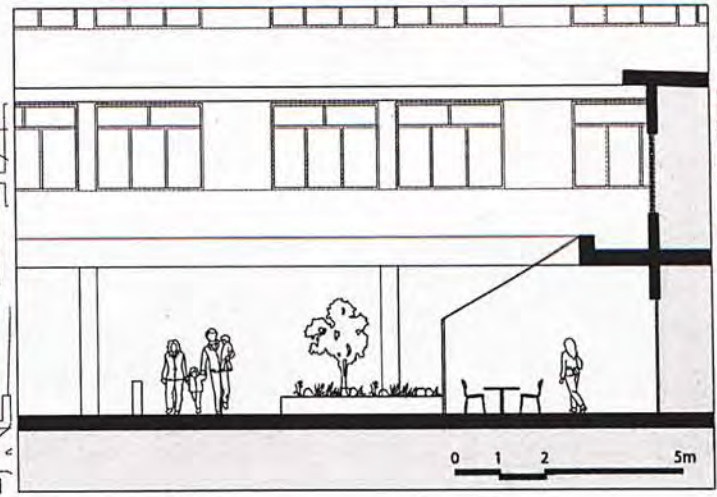
SECTION A

SECTION B

ENCLOSURE
- Enclosed totally, in 2 "U" shapes
- Divided into 2 parts by the road

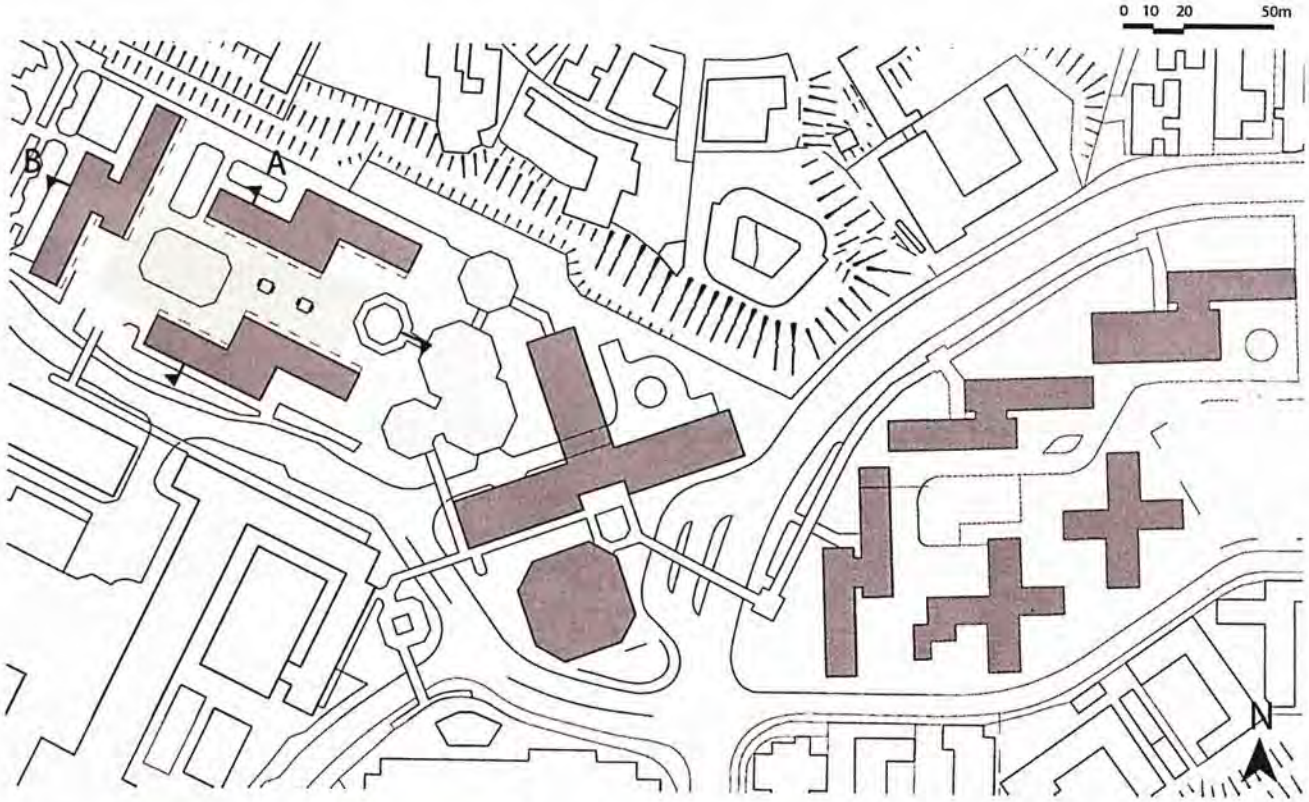


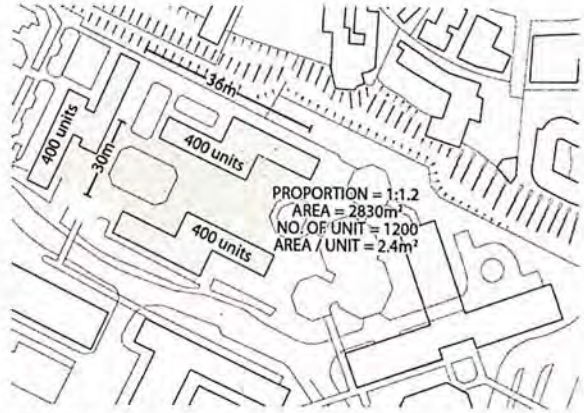
ACCESSBILITY



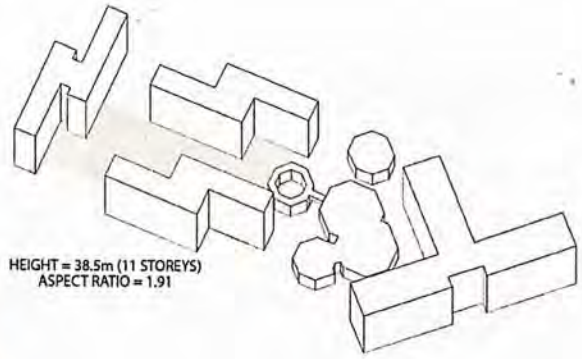
CANOPY & TEMPORARY COVERED AREA

TAI HANG TUNG ESTATE (1980)

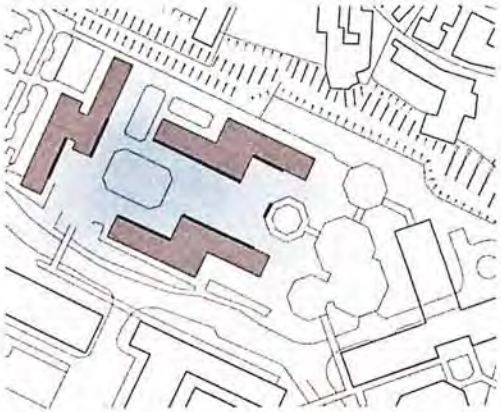


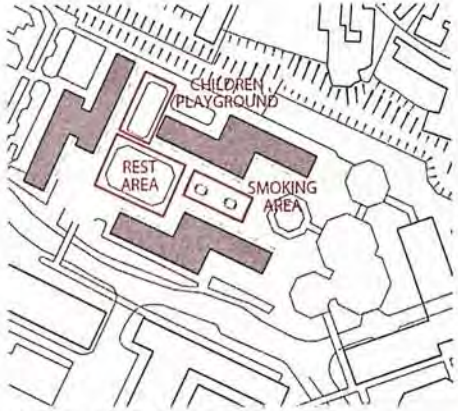


DIEMNSION, PROPORTION & NO. OF UNIT

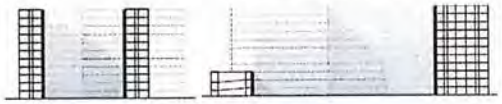


DEPTH & ASPECT RATIO (AREA / HEIGHT²)



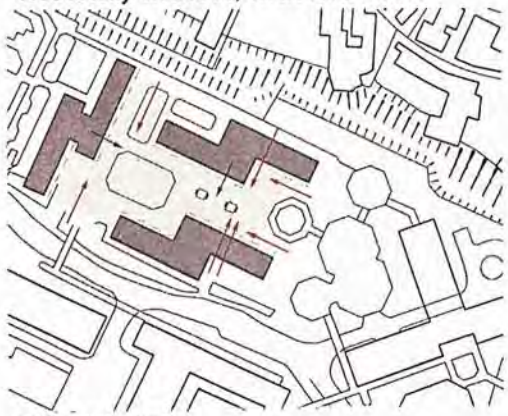


NO. OF DIVISIONS = 3

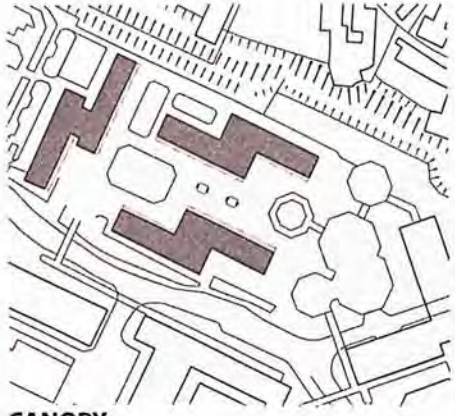


SECTION A SECTION B

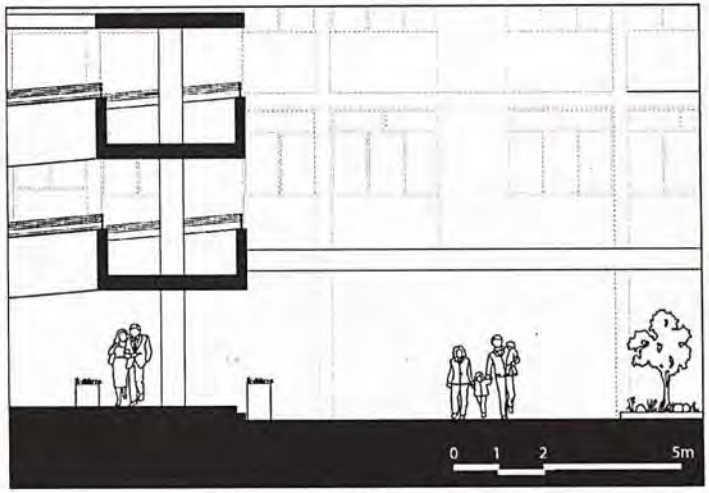
ENCLOSURE
- Enclosed by "Z" buildings with lost spaces
- Not totally enclosed, enclosure < 60%

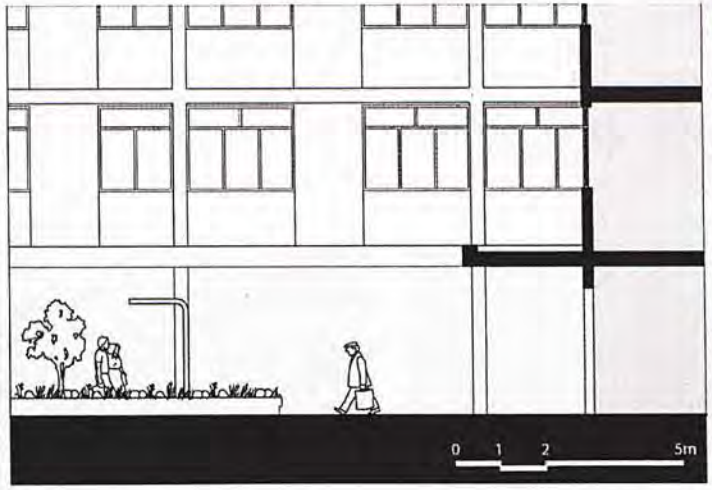


ACCESSBILITY

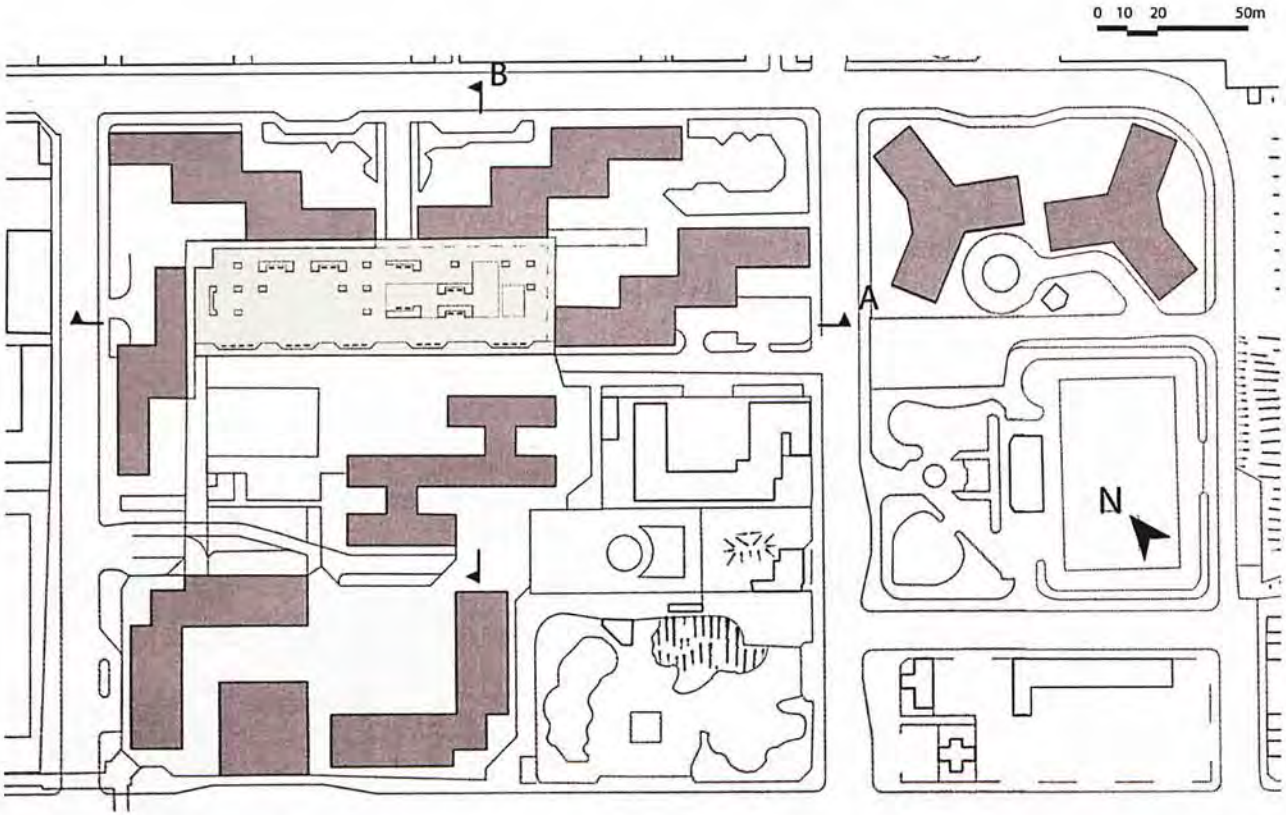


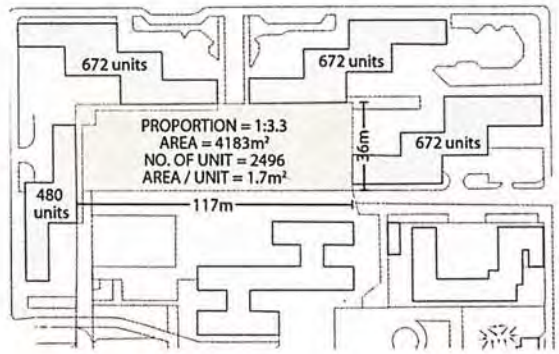
CANOPY



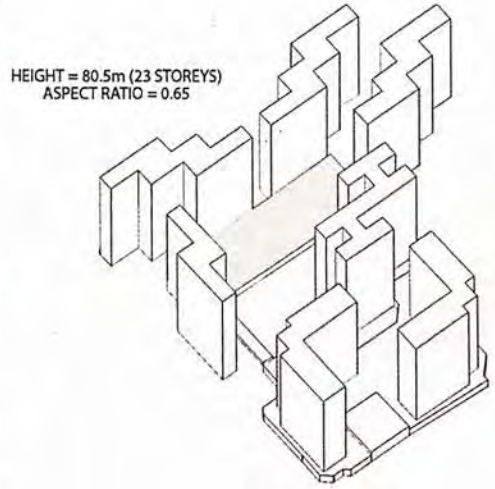


LEE CHENG UK ESTATE (1984)

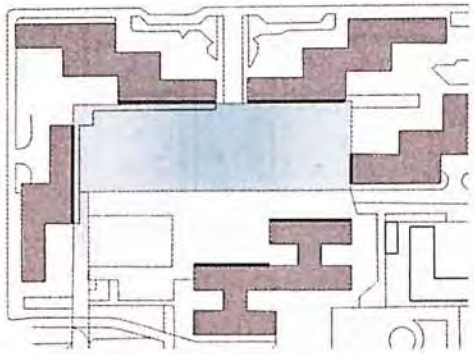


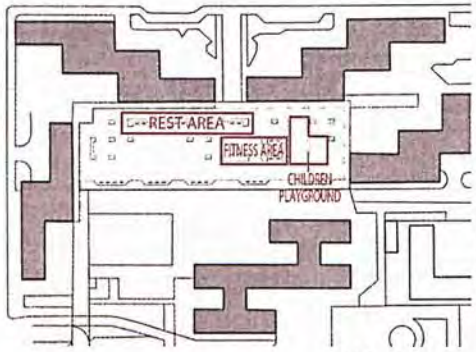


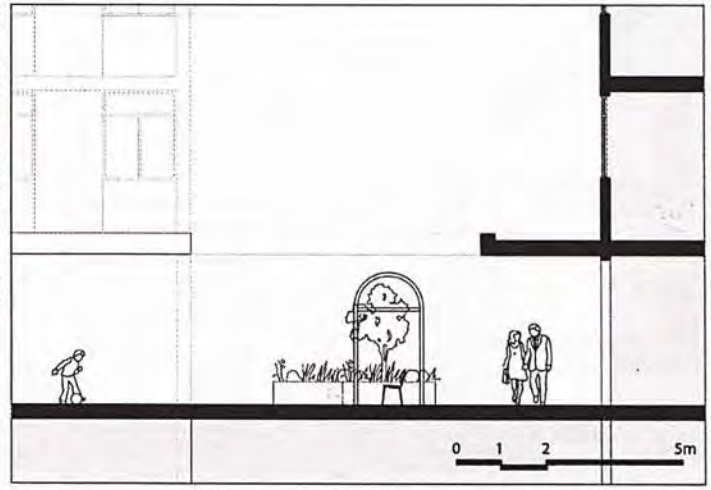
DIEMNSION, PROPORTION & NO. OF UNIT

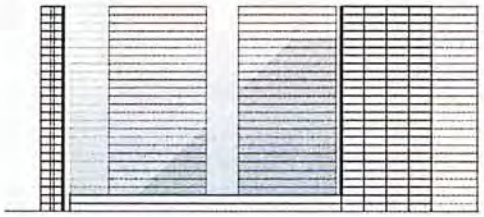


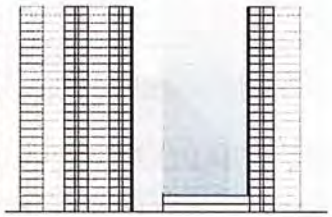
DEPTH & ASPECT RATIO (AREA / HEIGHT²)









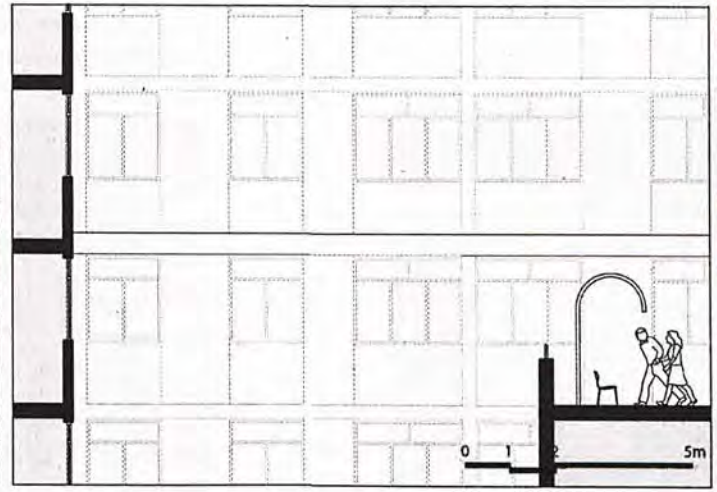


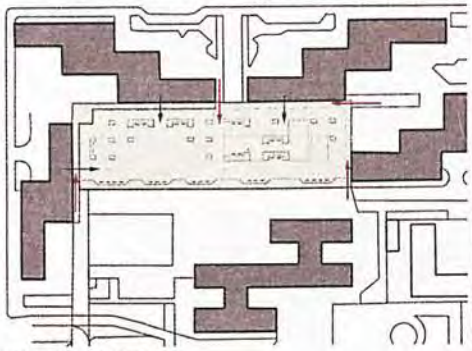
NO. OF DIVISIONS = 3

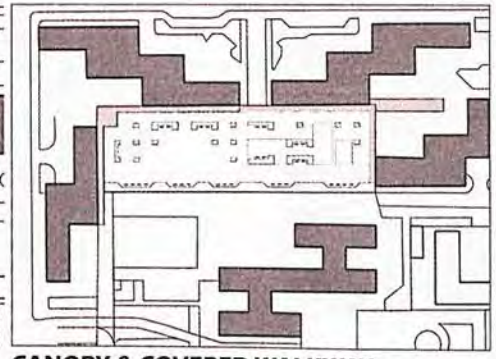
SECTION A

SECTION B

ENCLOSURE
- Bounded by podium physically
- Enclosed by surrounding buildings visually







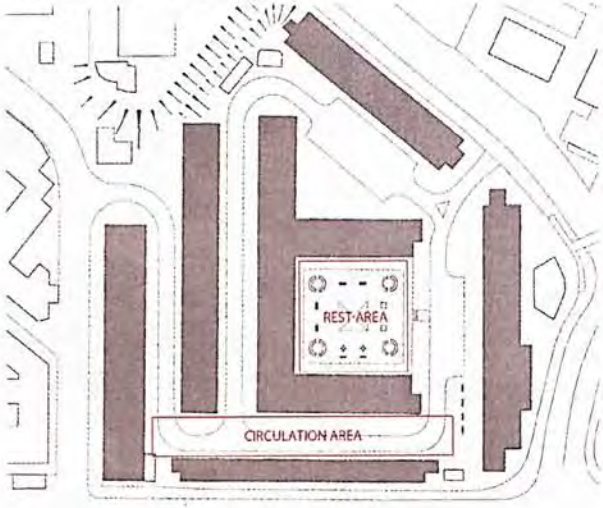
ACCESSBILITY

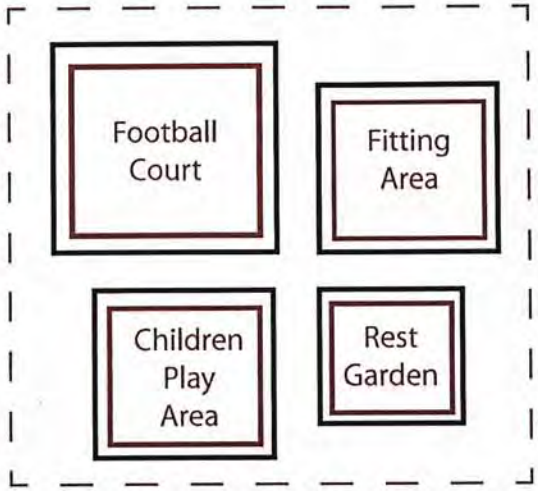
CANOPY & COVERED WALKWAY

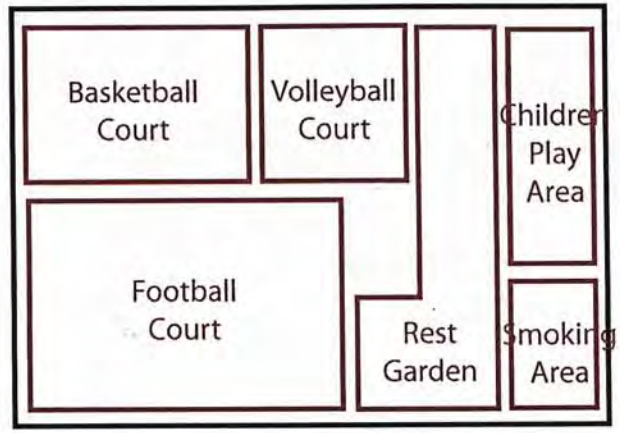
SUMMARY

SMALLER SIZE PREFERED

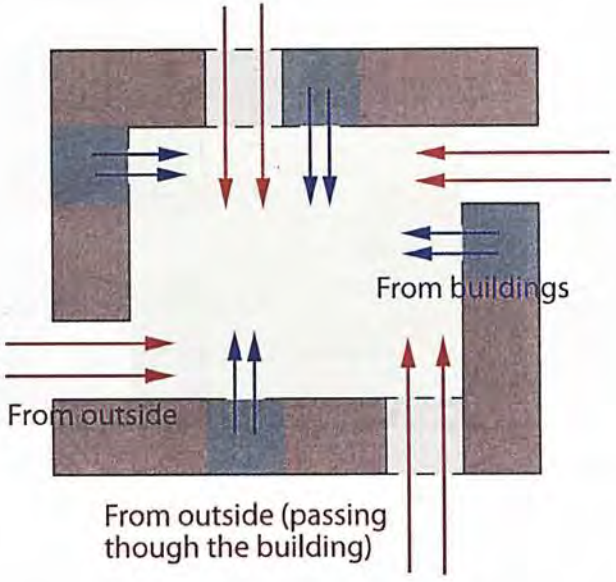
- Larger area - divided into parts with programs
- Smaller area - less programs - PREFERABLE





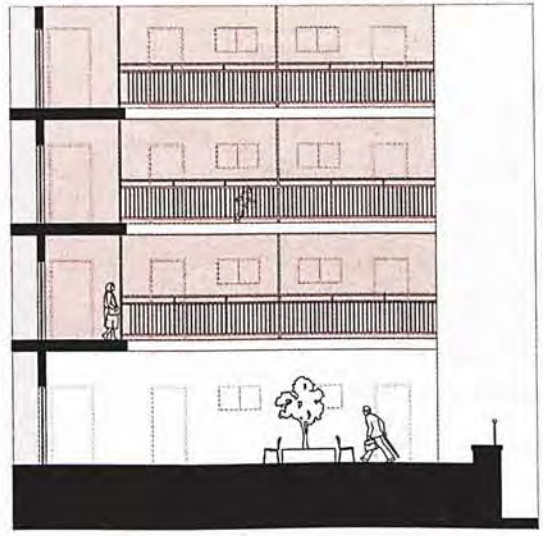


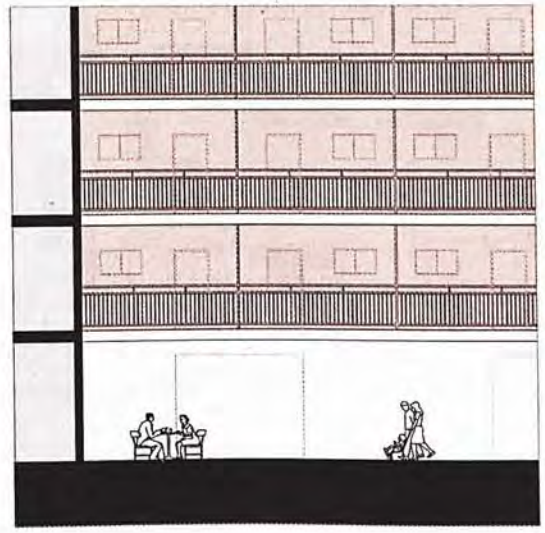
3 KINDS OF ACCESSIBILITY



CORRIDOR FACING THE COURTYARD AS A VARIATION

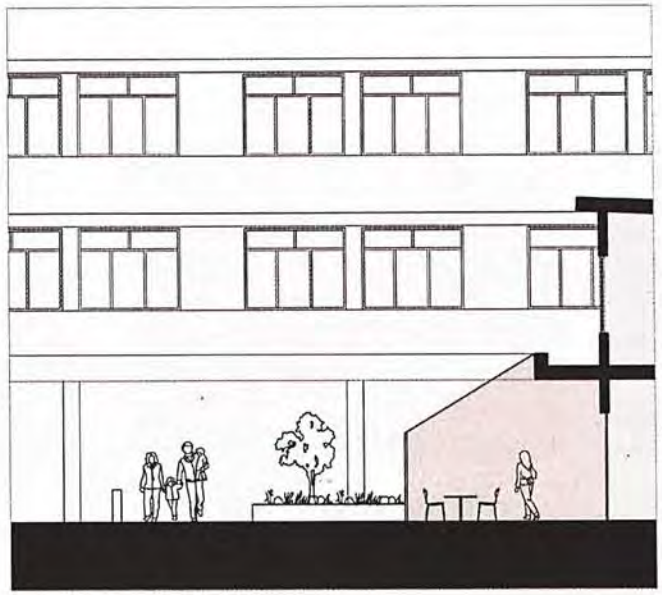
- Interaction between the corridor the and courtyard
- Wider corridor for providing more communal space





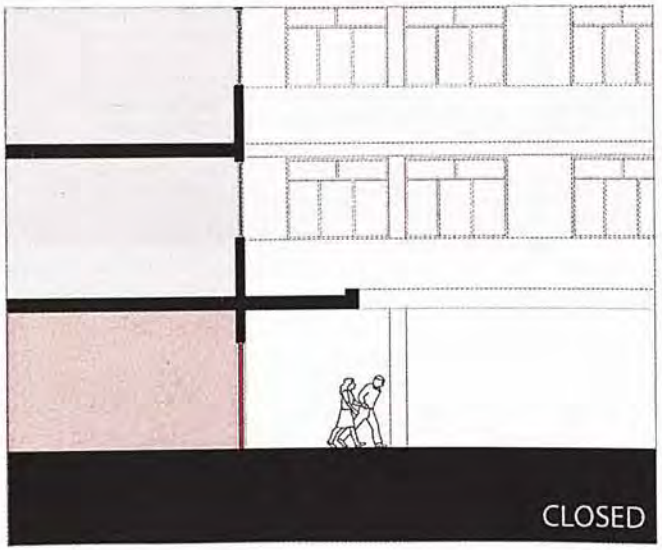
COVERED WALKWAYY

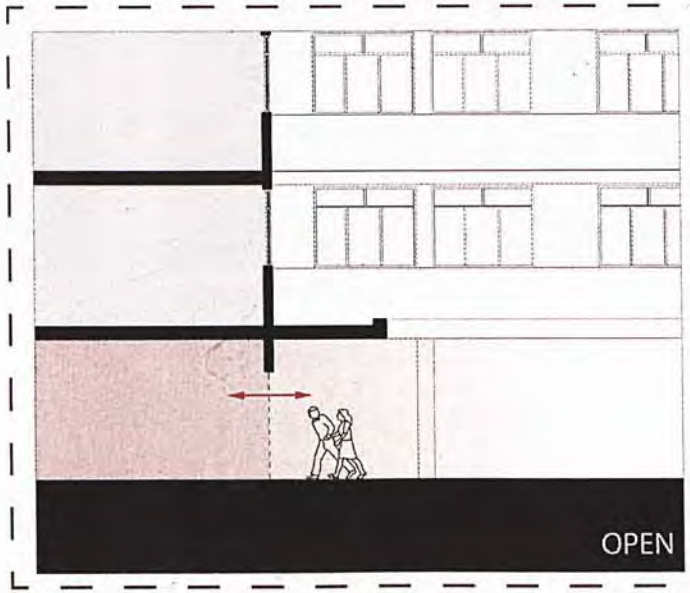
- As a walking path for pedestrian
- Semi-open layer as transition



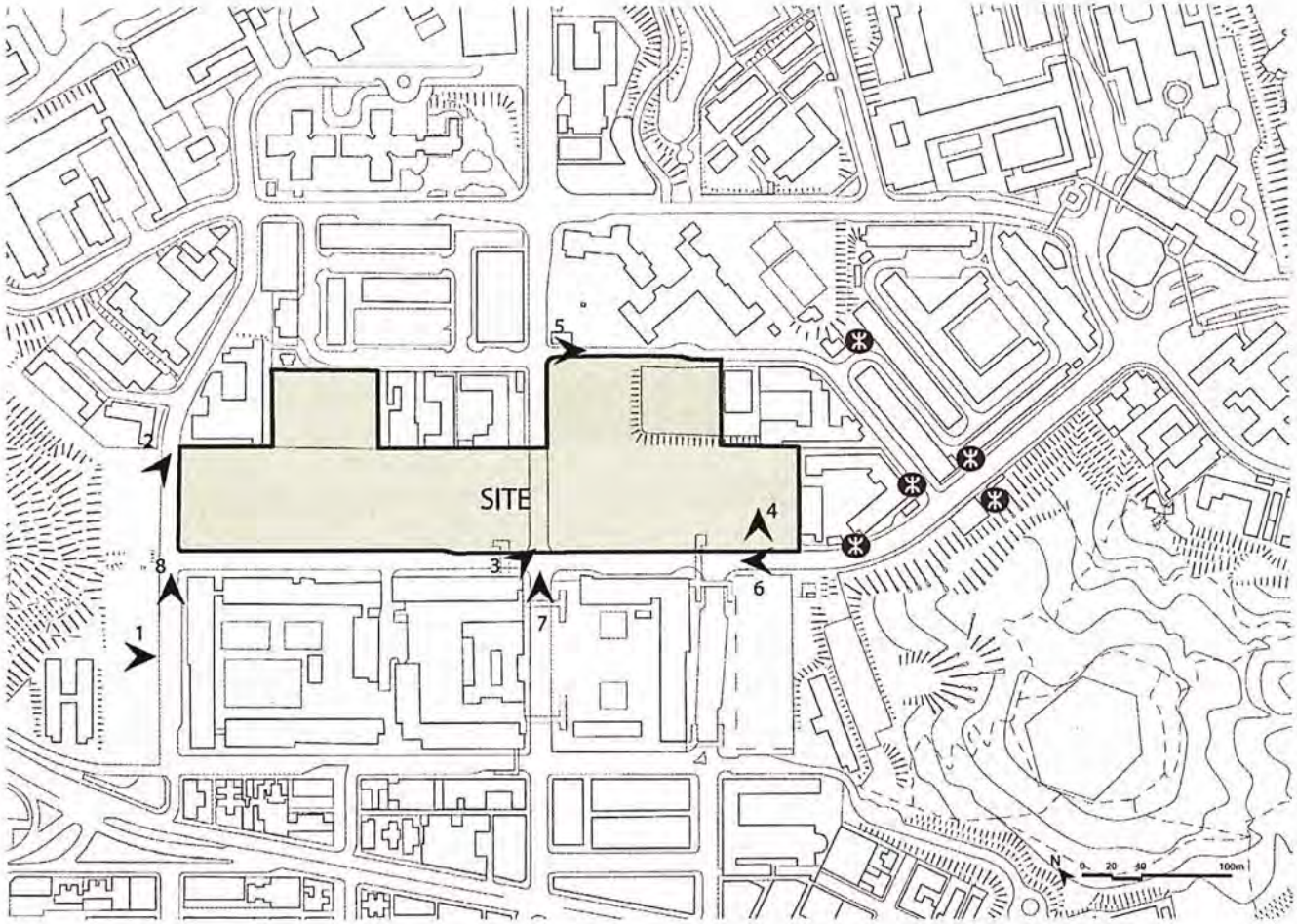
OPEN SHOP AT THE EDGE OF COURTYARD PREFERED

- Shops / Restaurant - open to the courtyard - PREFERABLE
- Office / Workshop / Kindergarten - closed and private, not much relationship with the courtyard





SITE ANALYSIS



KEY PLAN

1 SHEK KIP MEI ESTATE

2 JCCAC

3 SITE (UNDER CONSTRUCTION)

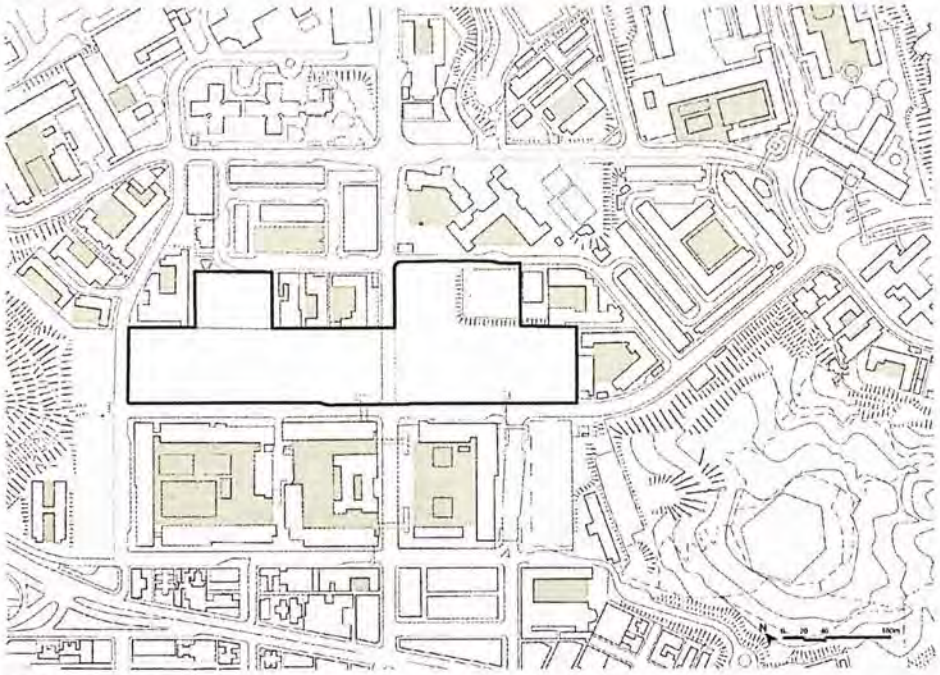
5 WAI CHI STREET

7 NAM CHEONG STREET

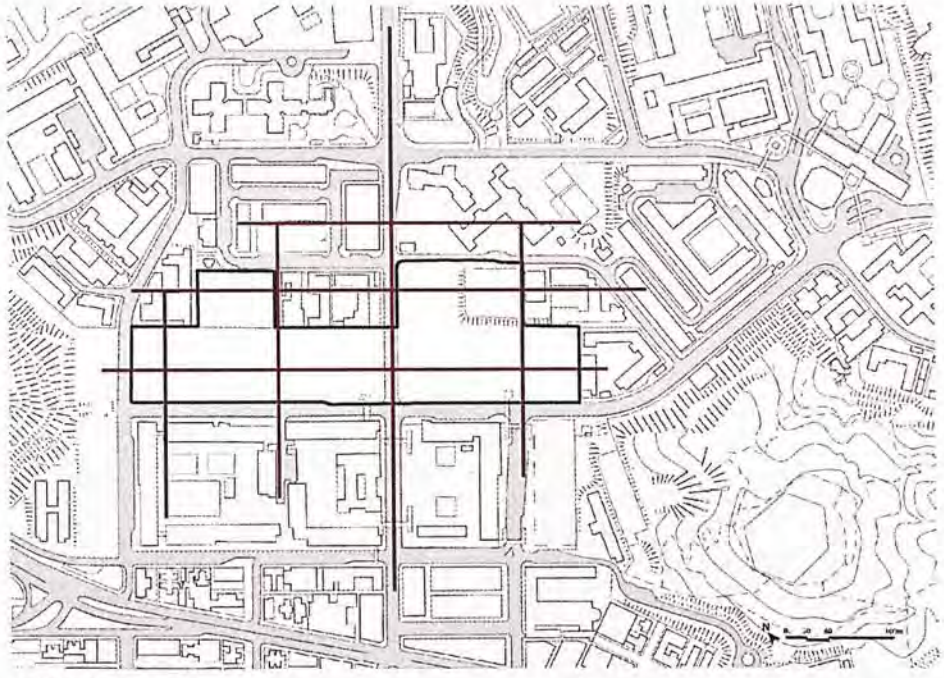
4 IN THE SITE

6 WOH CHAI STREET

8 PAK TIN STREET



COURTYARD



AXIS & ROAD

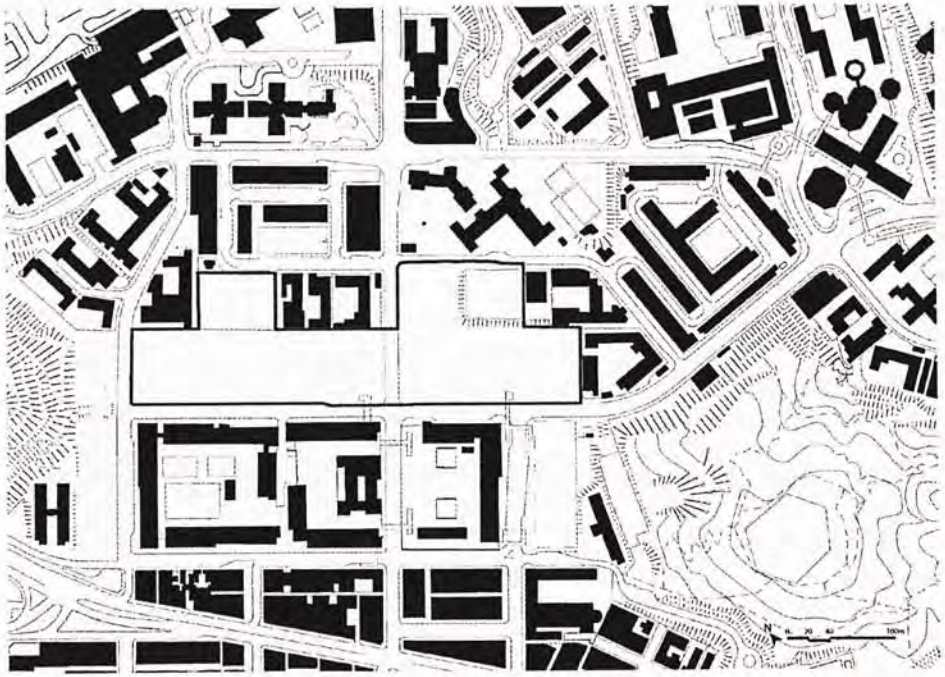
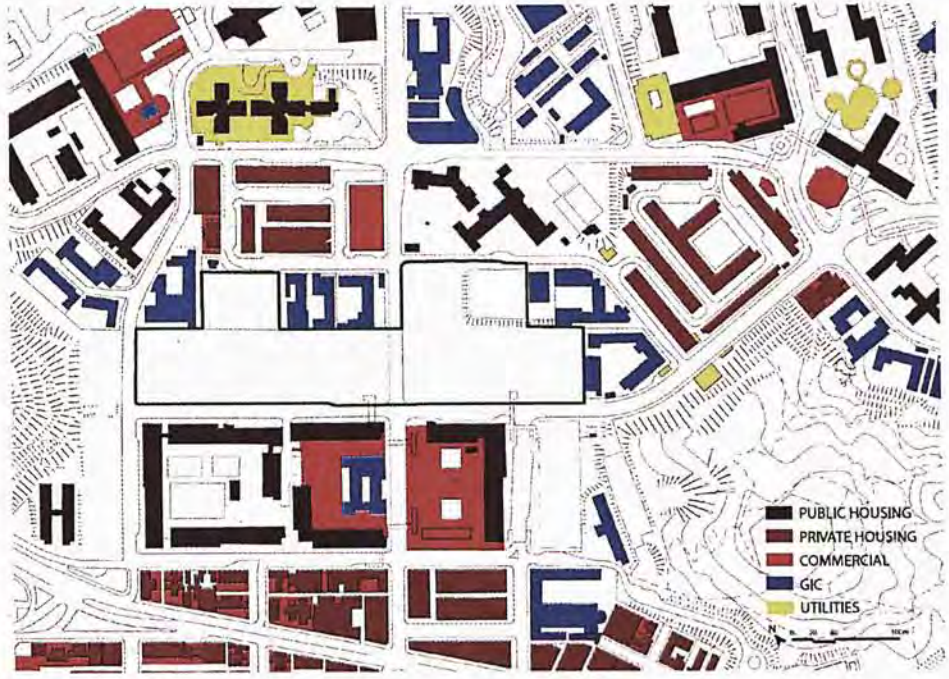
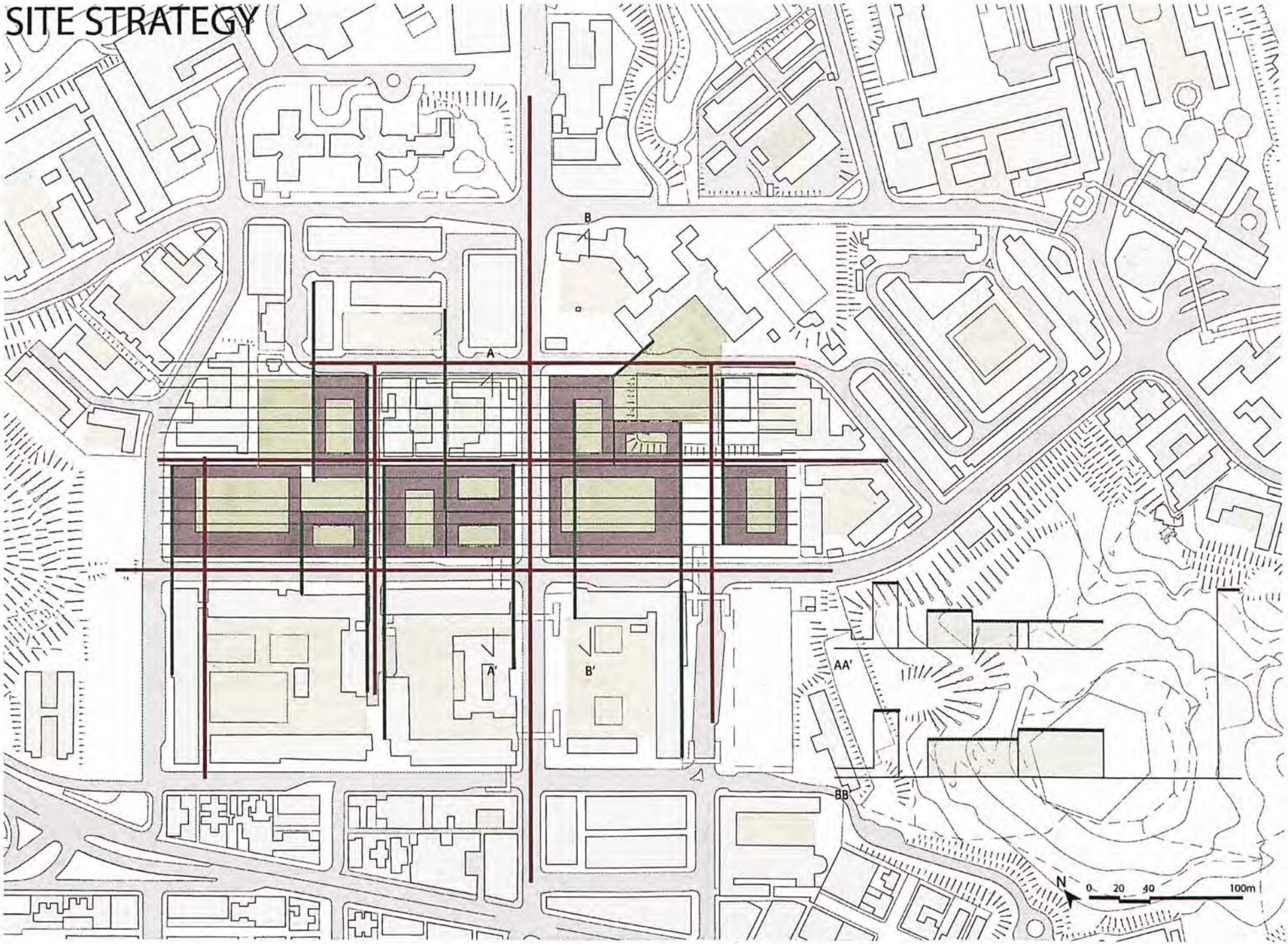


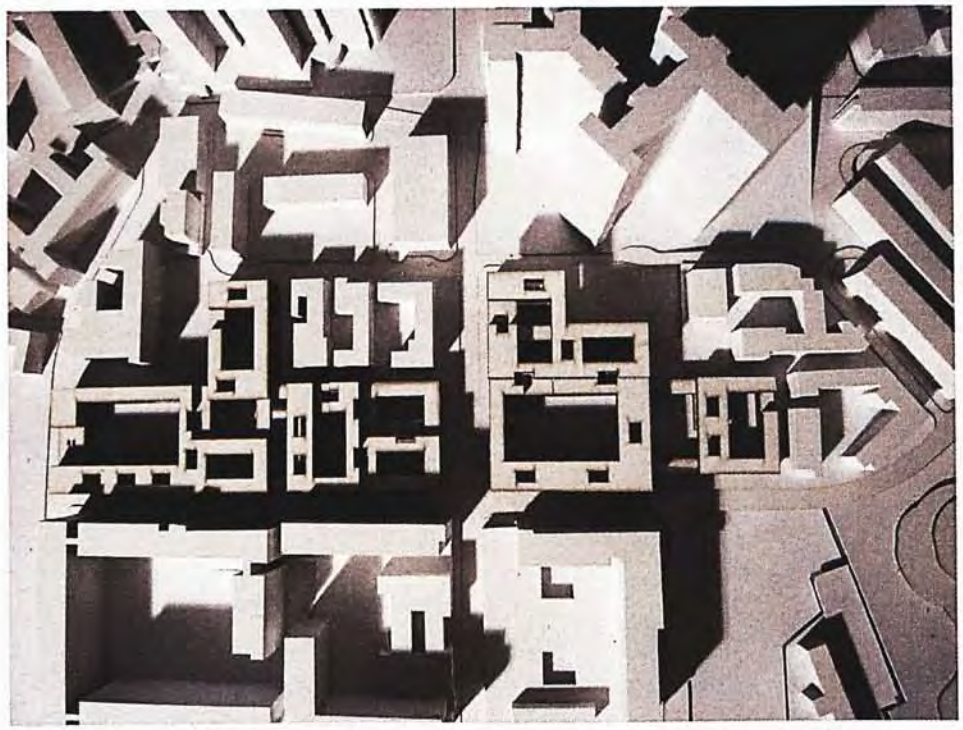
FIGURE & GROUND



PROGRAM

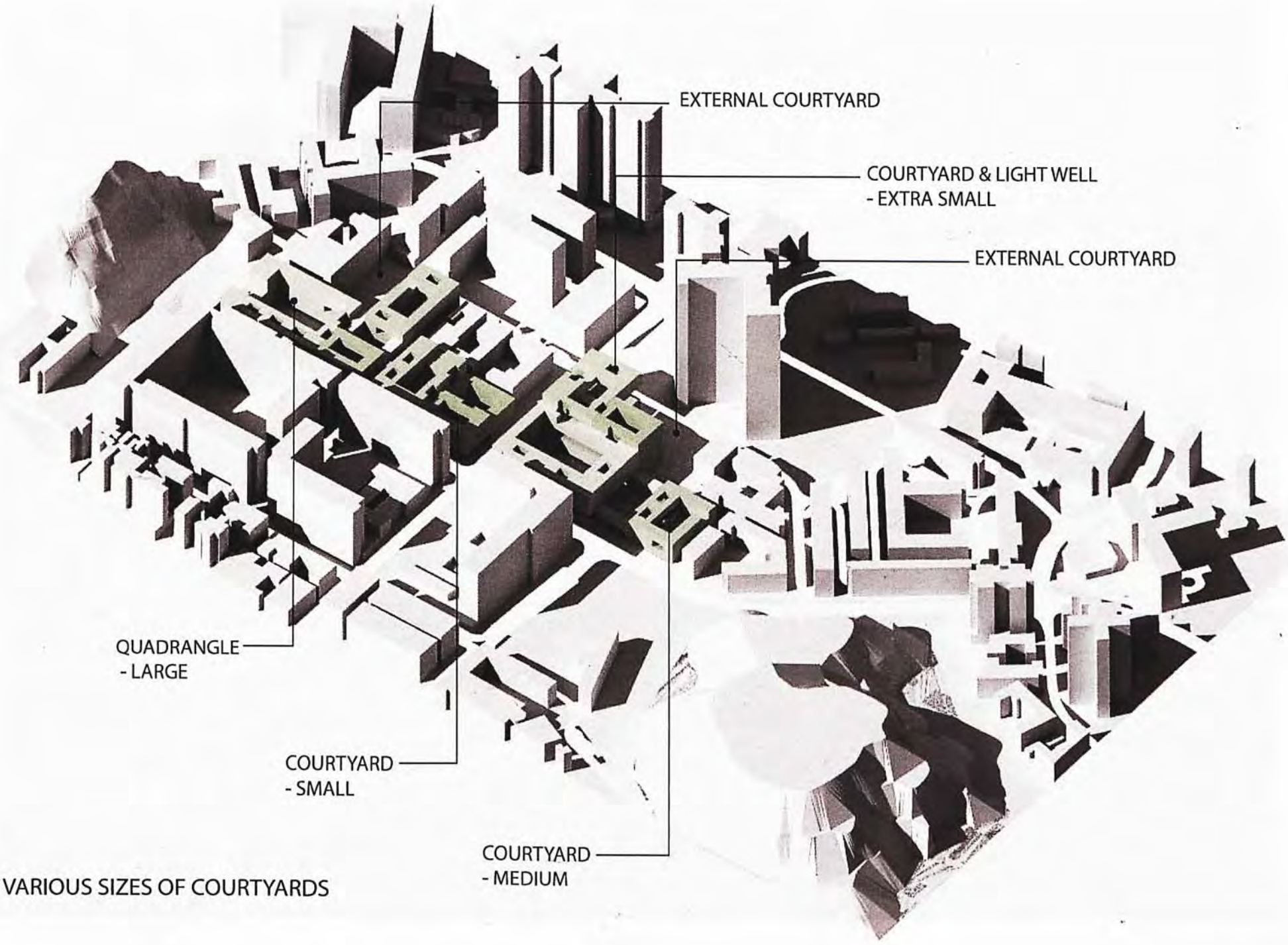
SITE STRATEGY



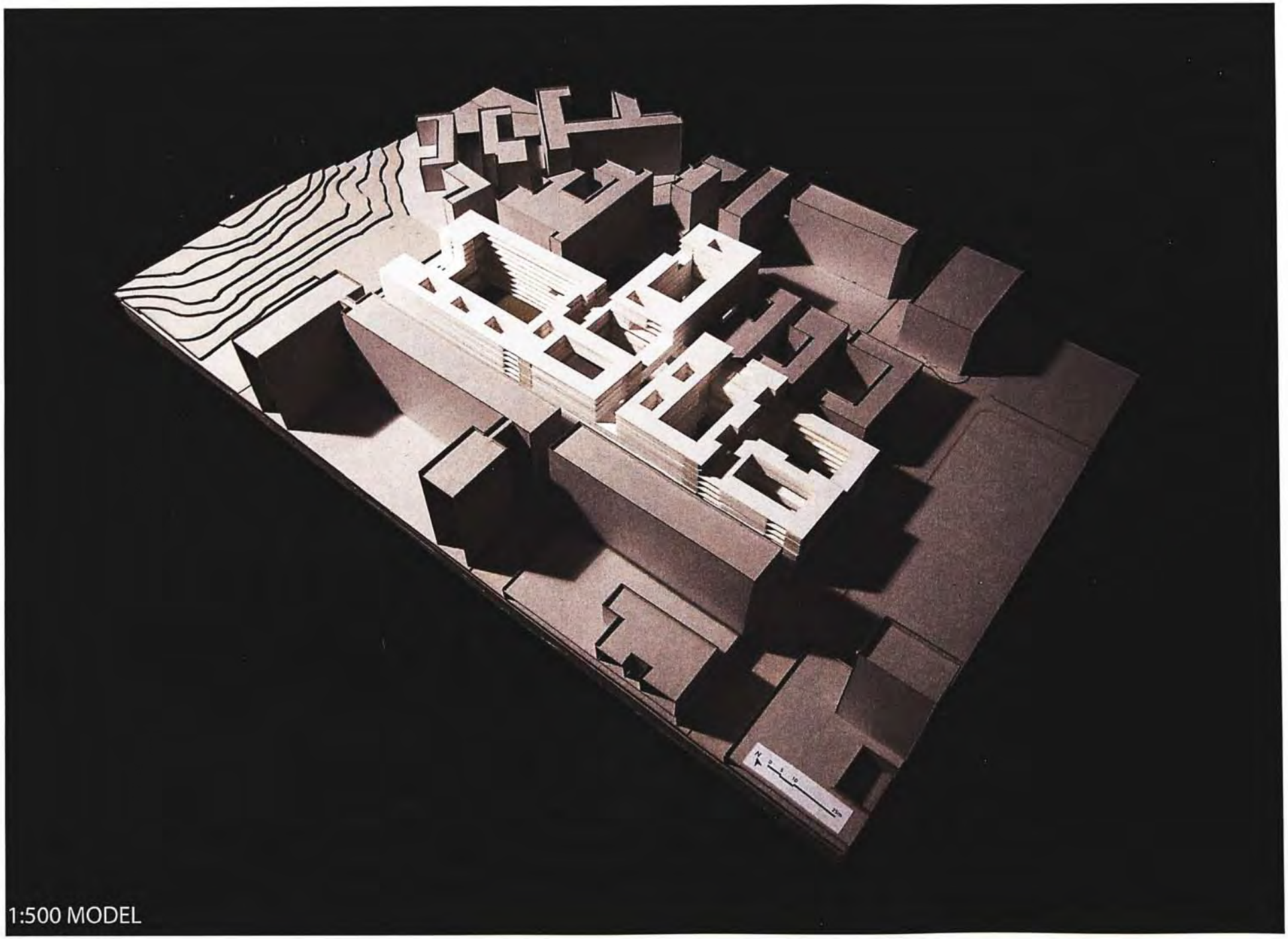


1:1000 SITE MODEL

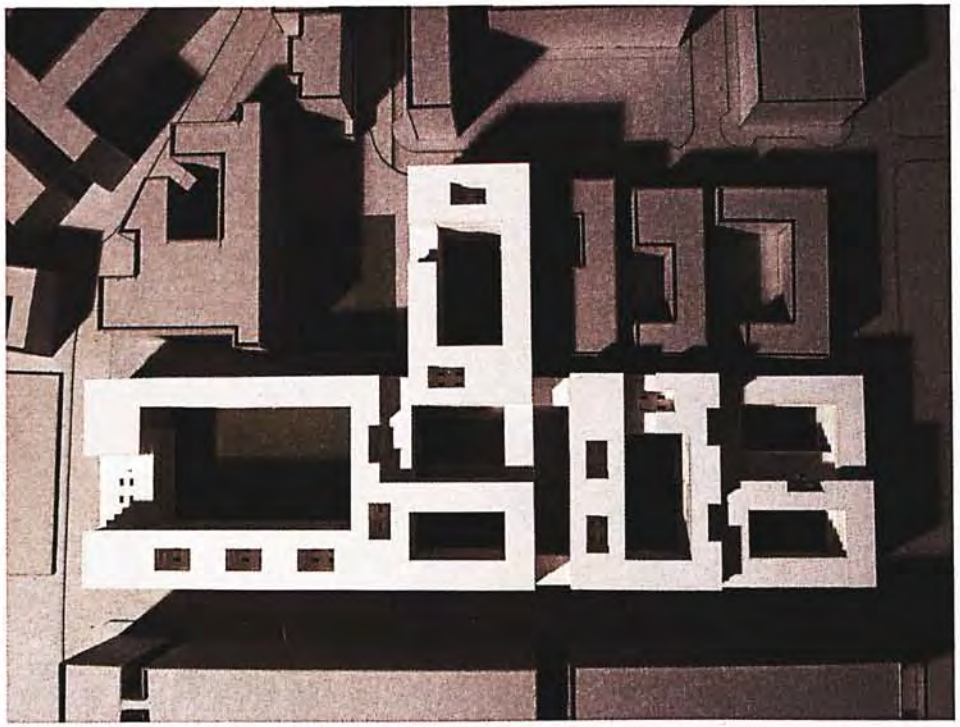
SITE PLAN

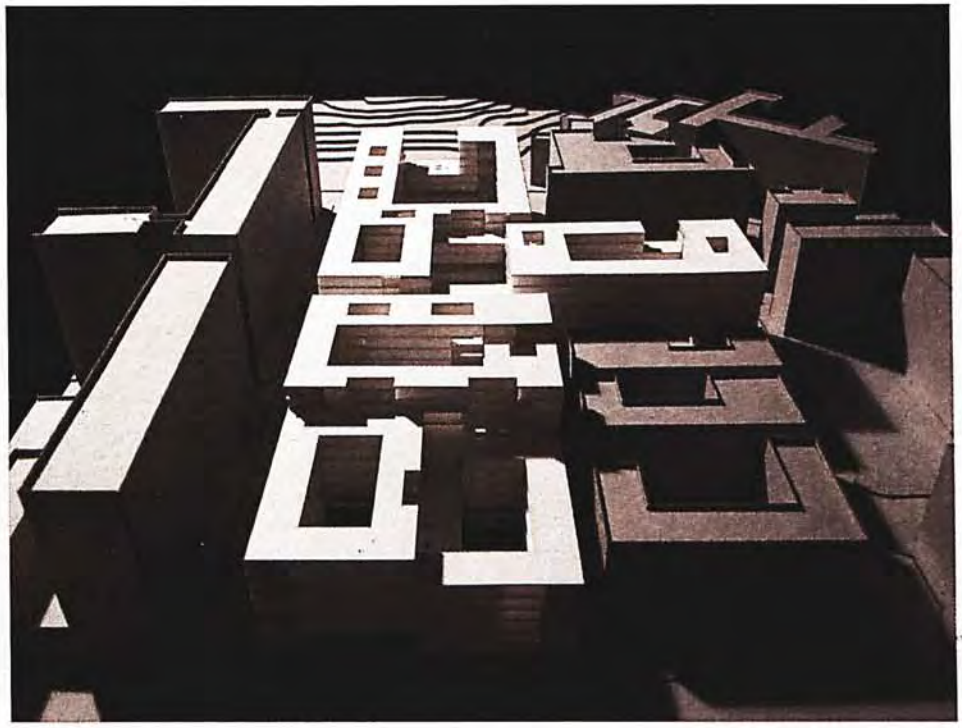


VARIOUS SIZES OF COURTYARDS

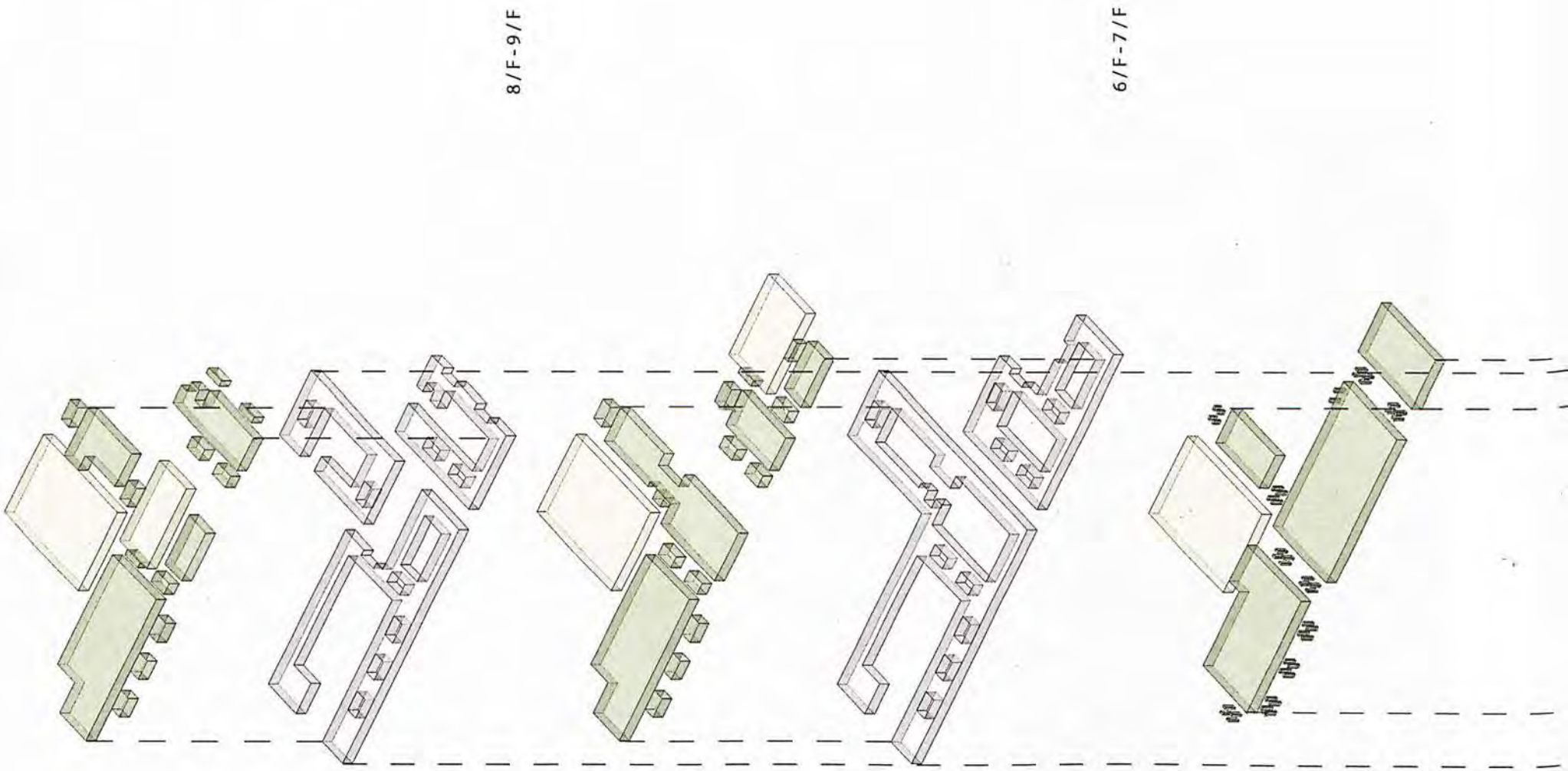


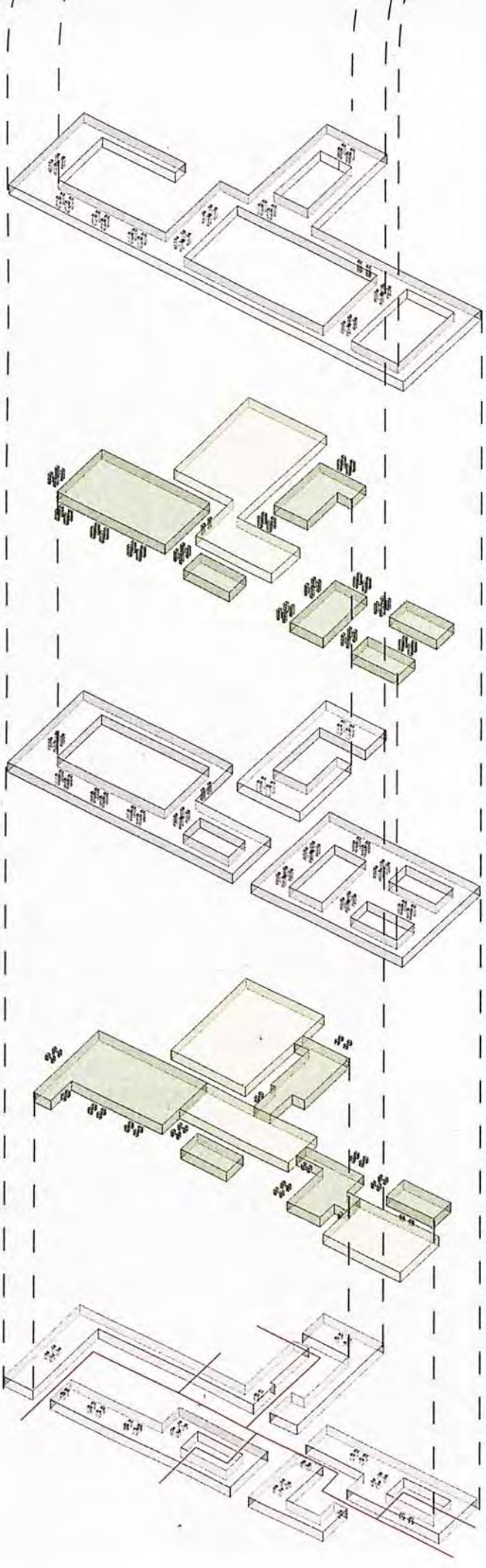
1:500 MODEL





ORGANIZATION





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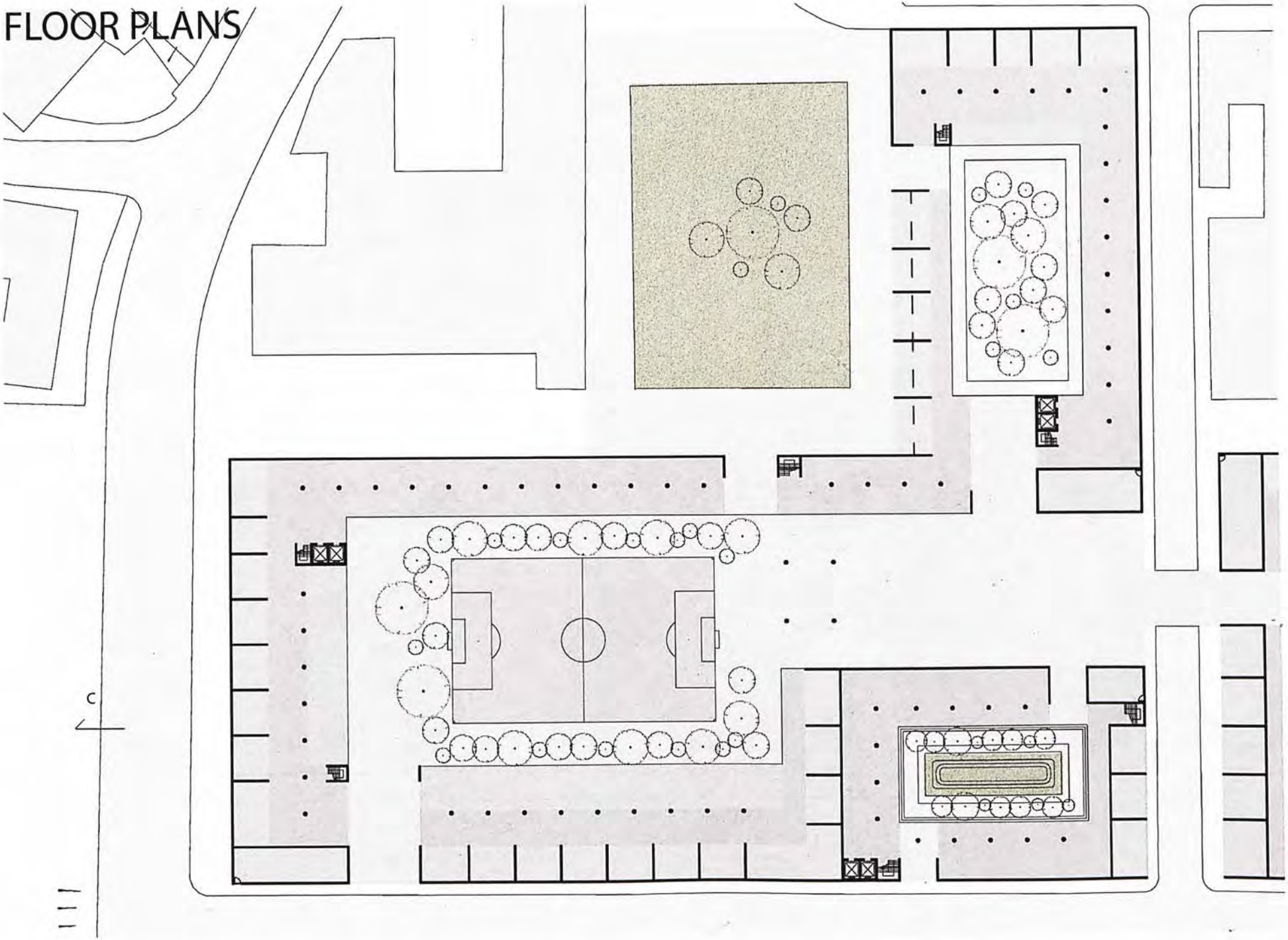
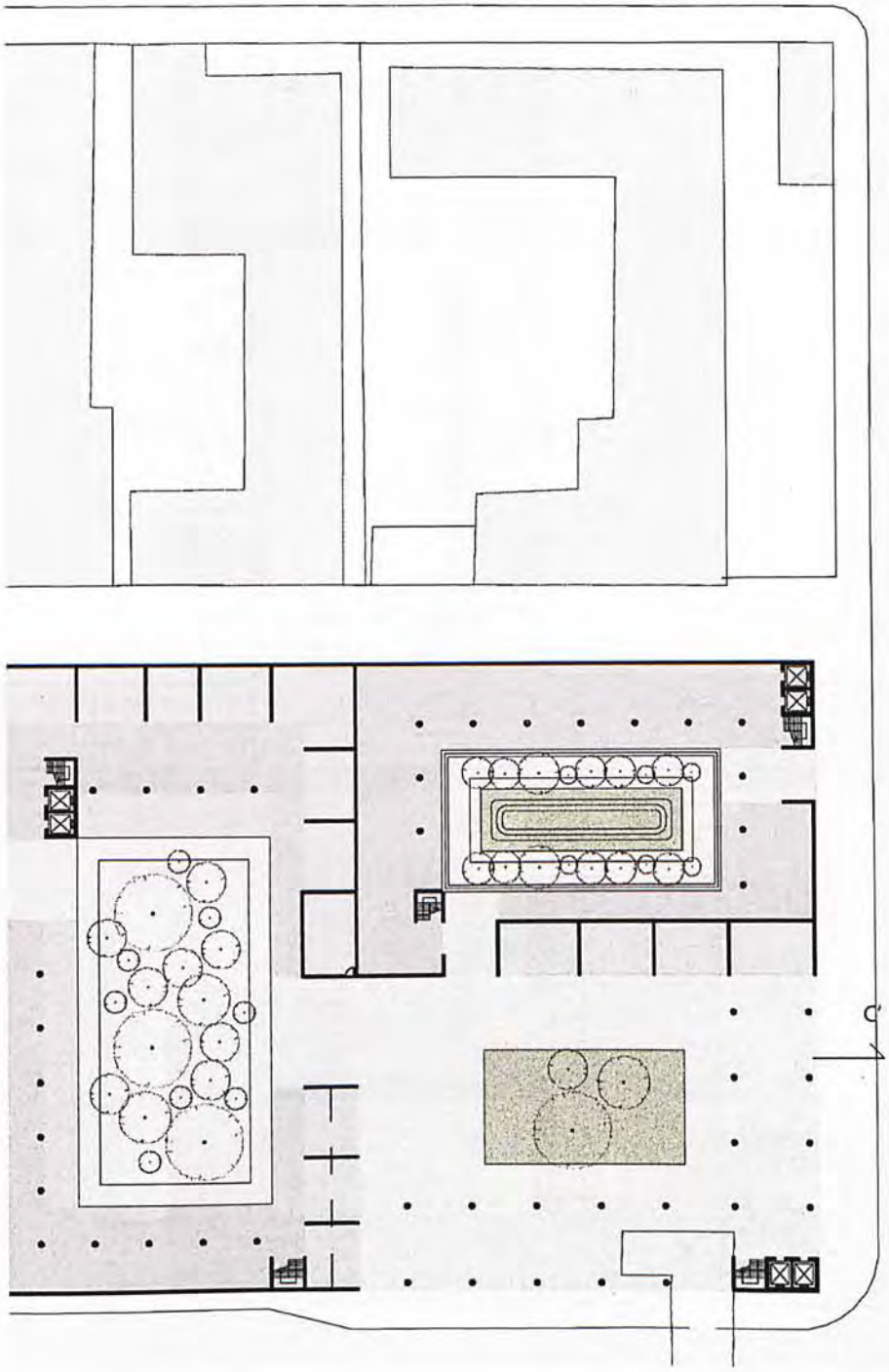
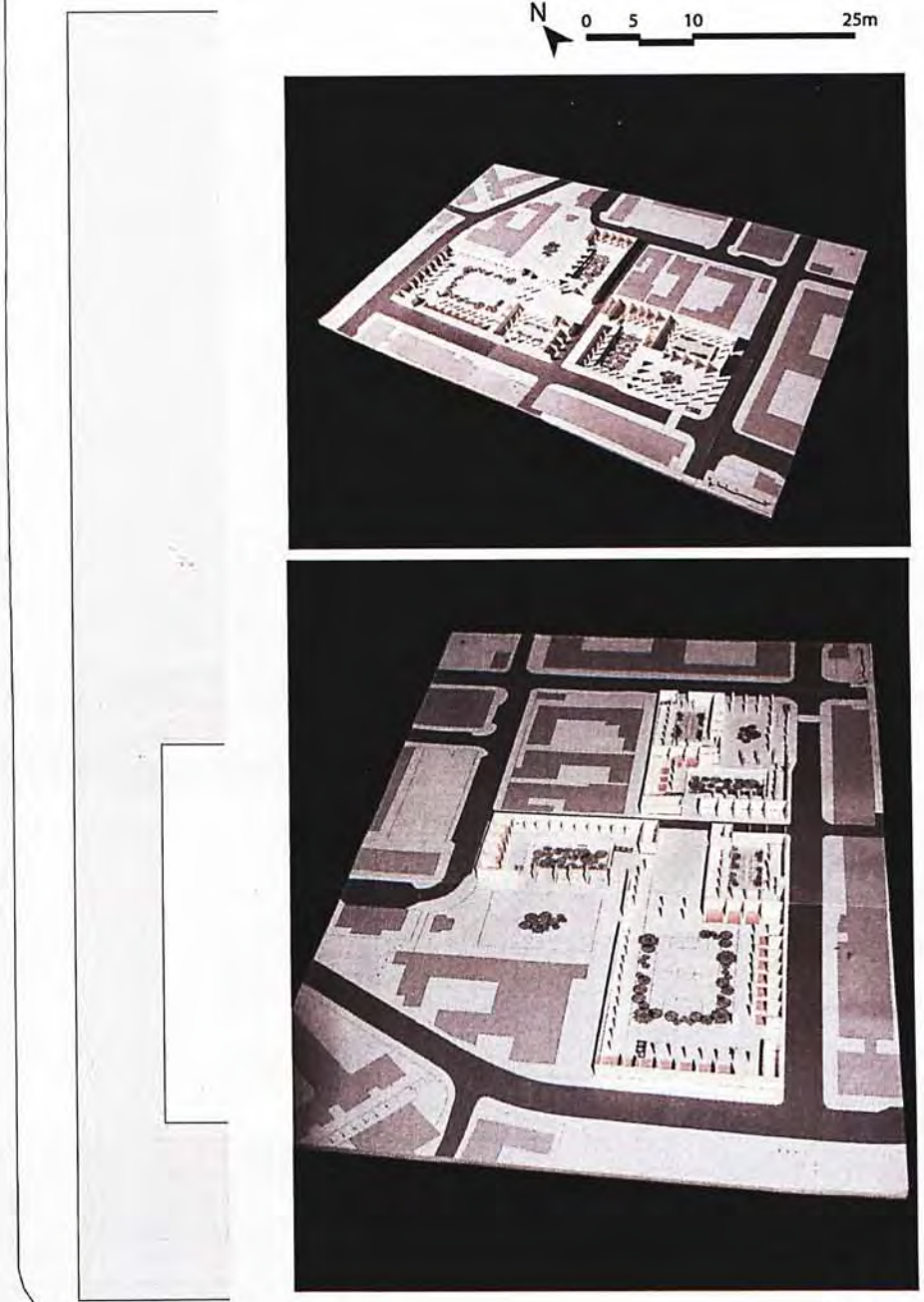
FLOOR PLANS







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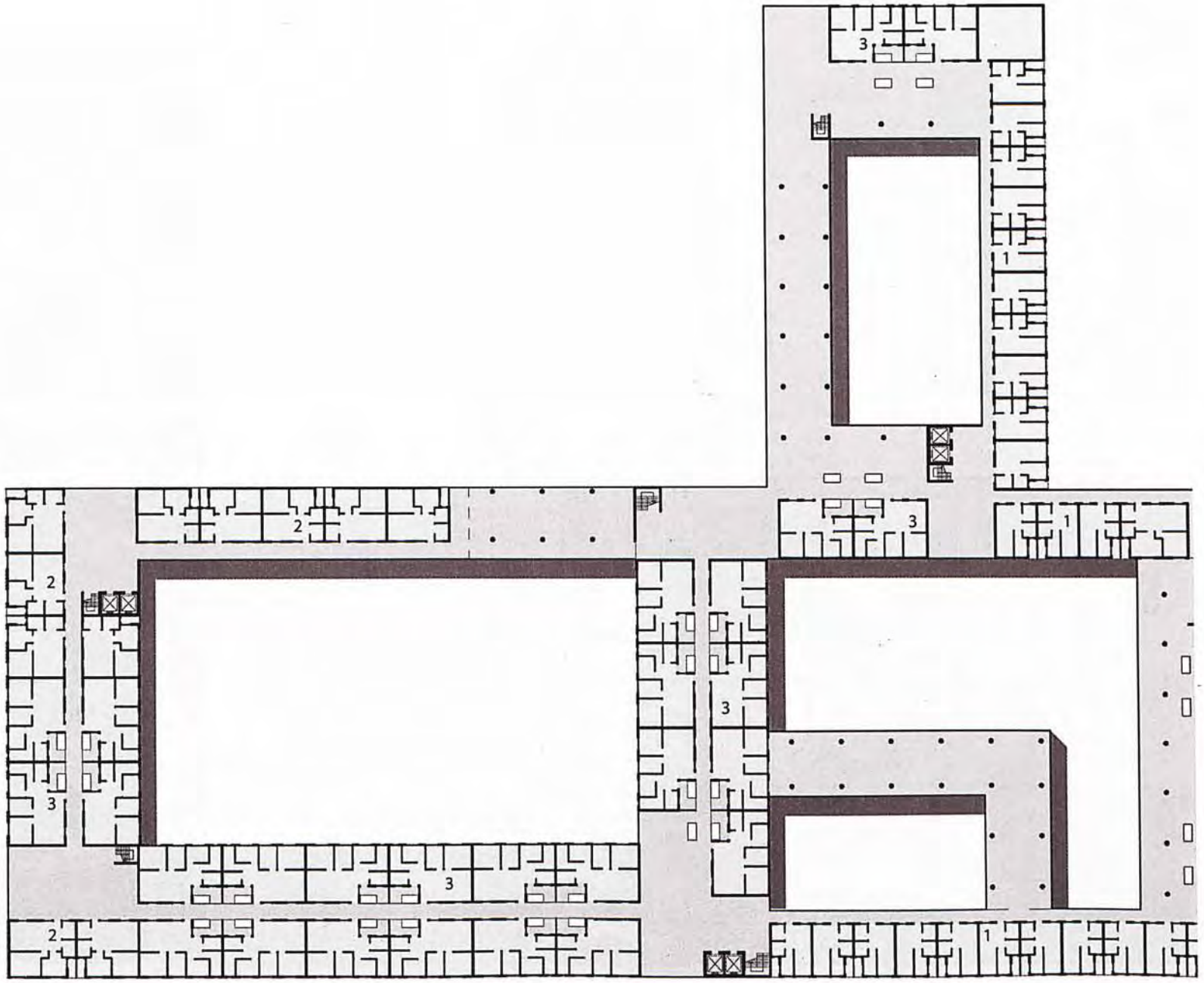
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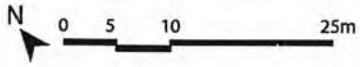

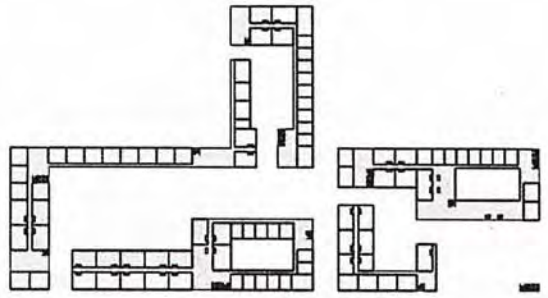

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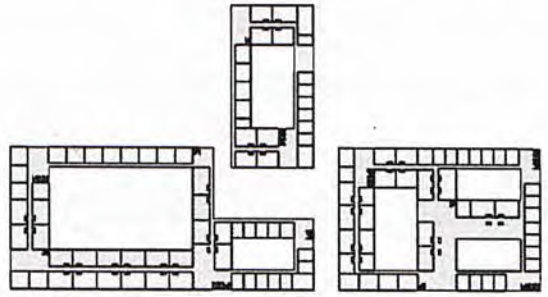

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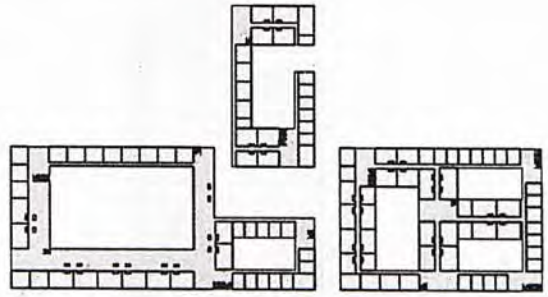

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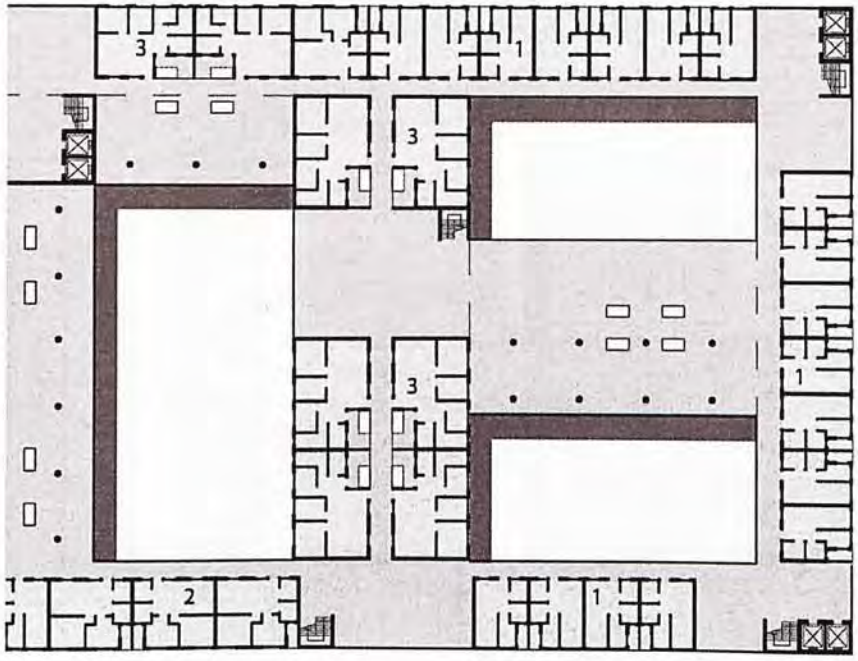

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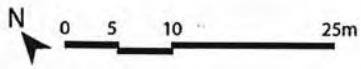

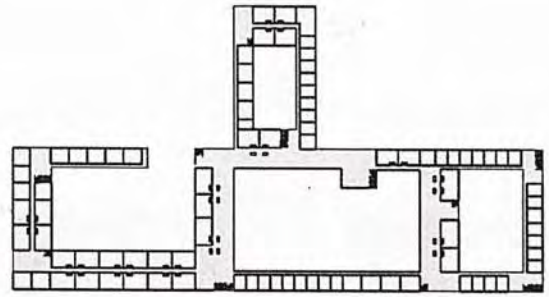

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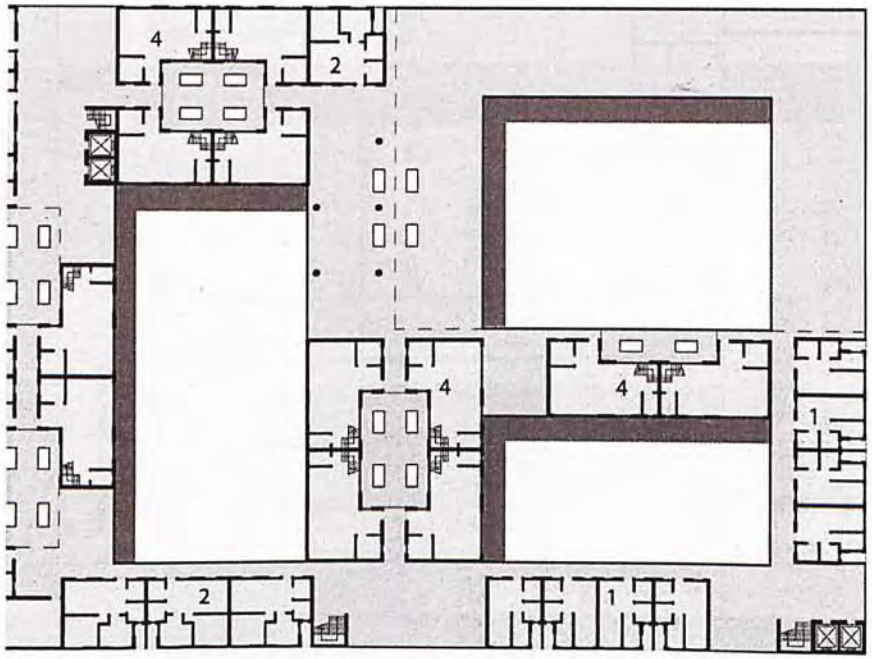

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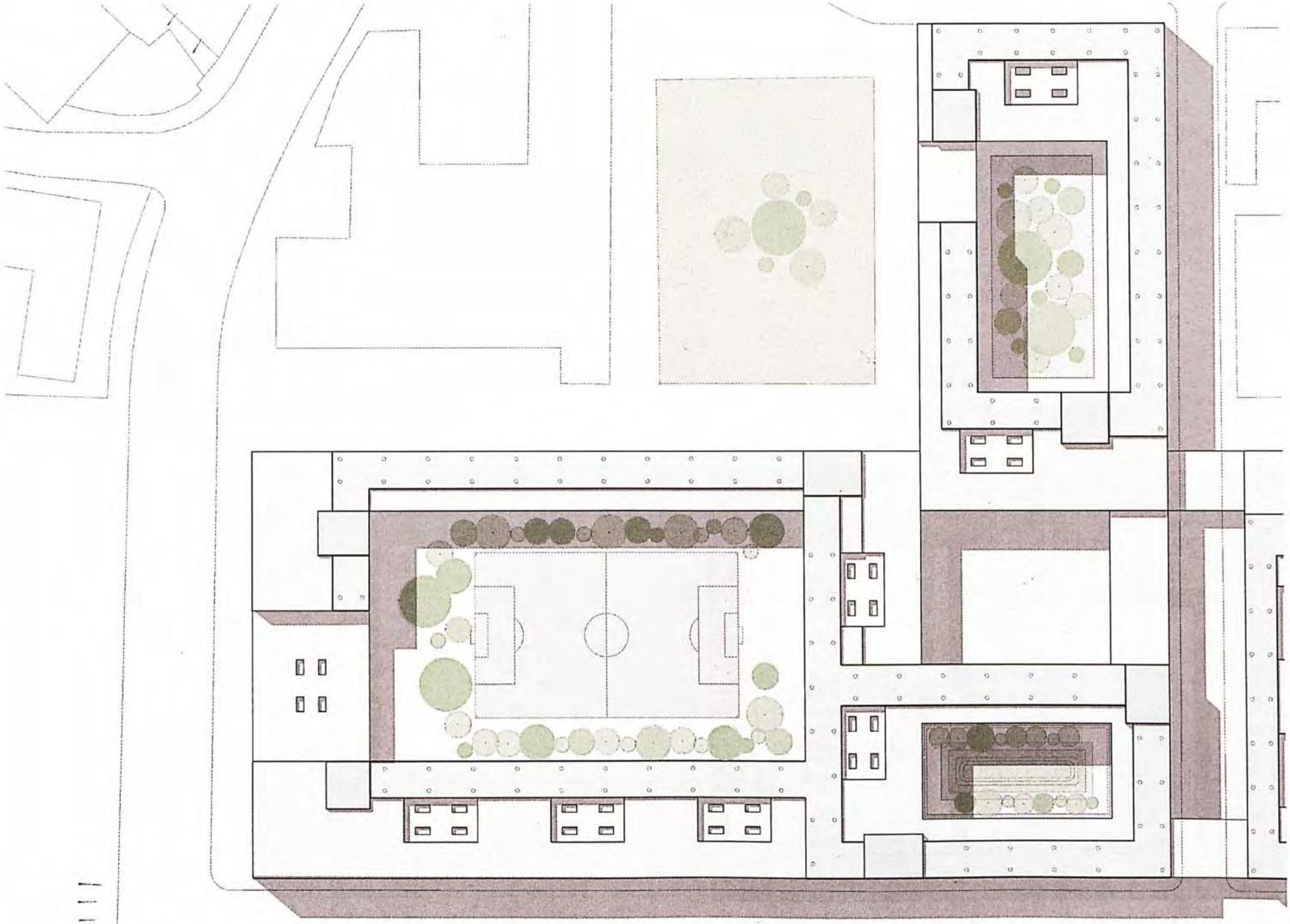

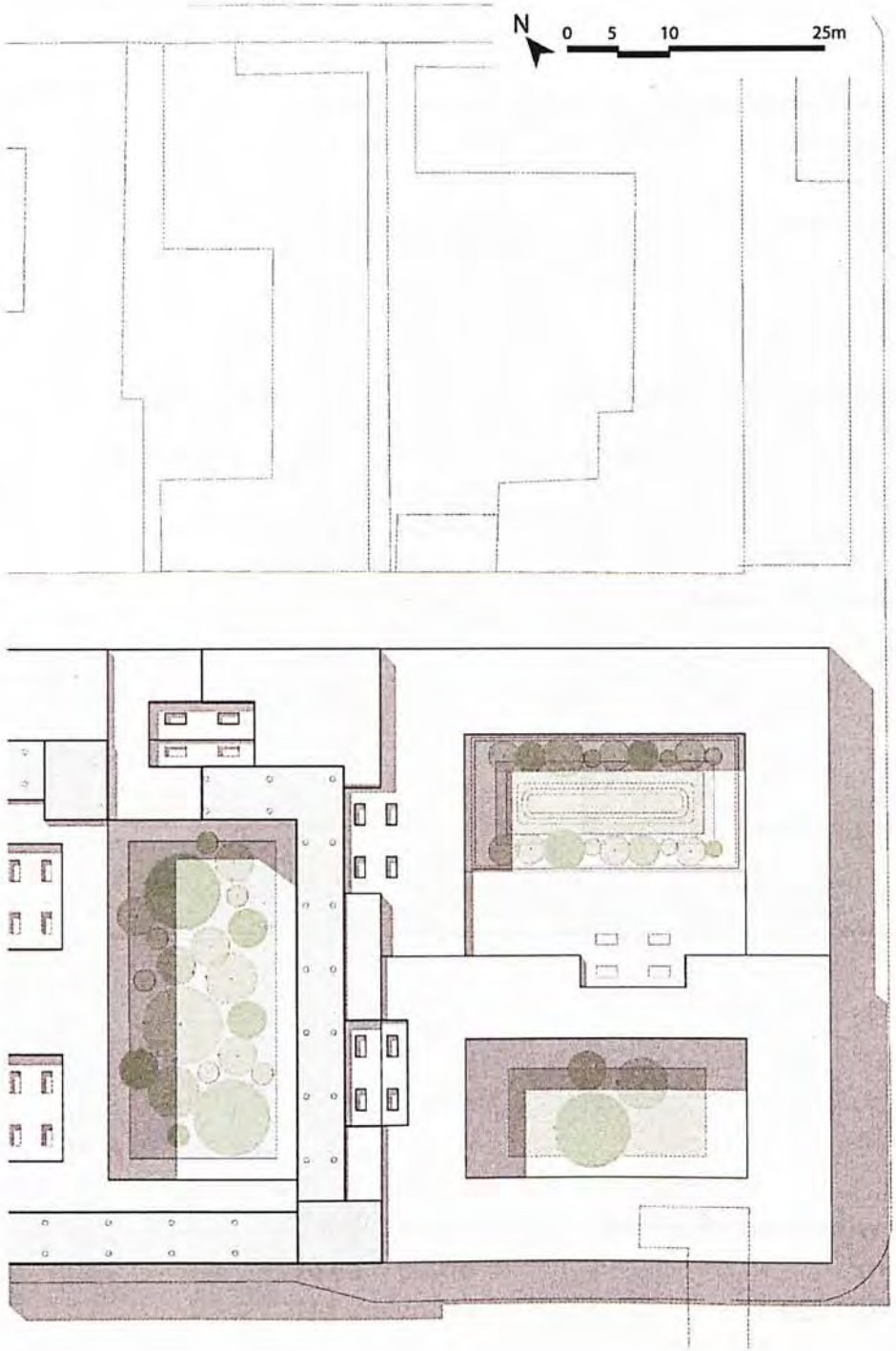

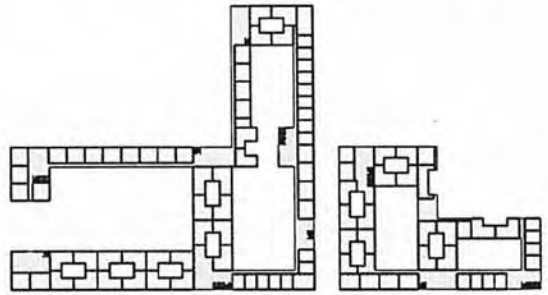

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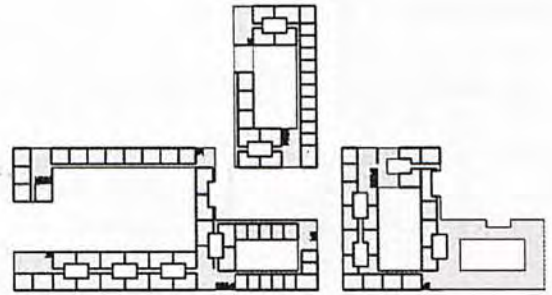

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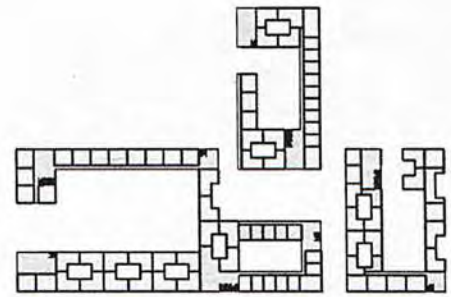
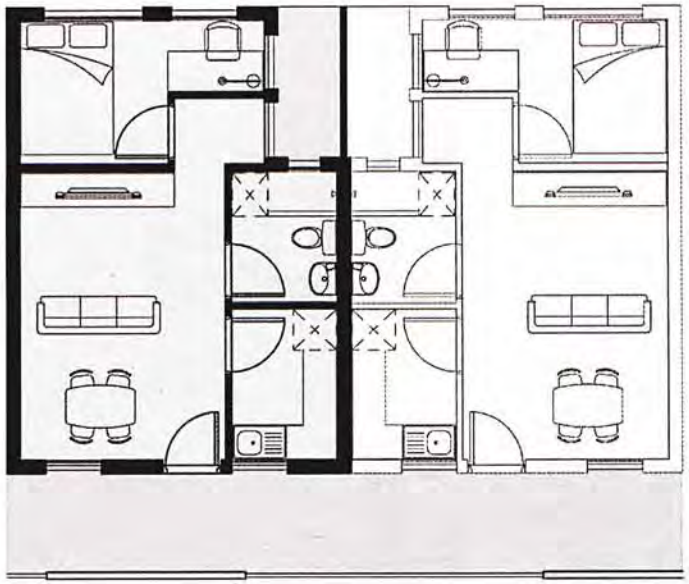


9 / F

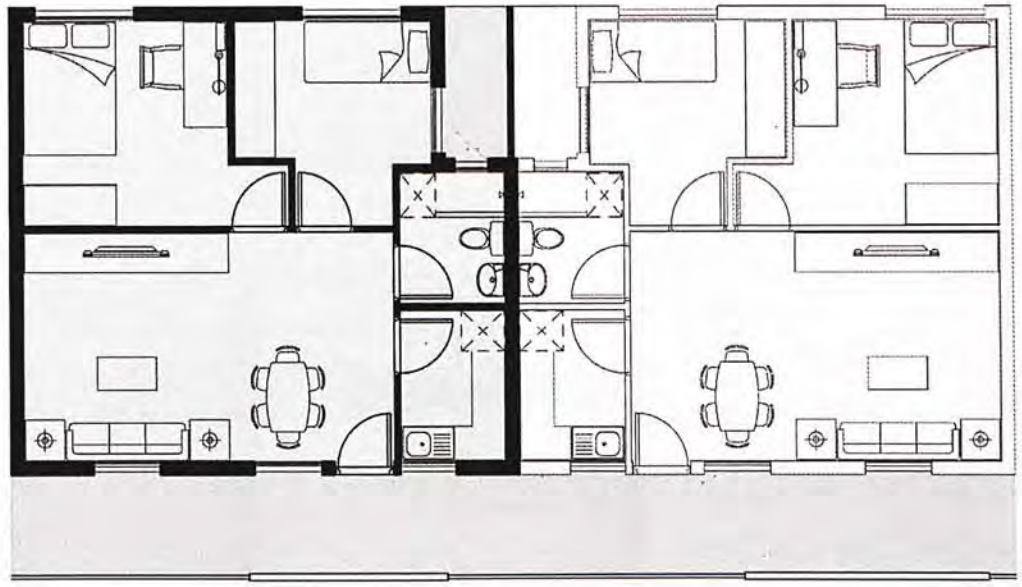
R/ F

UNIT PLANS

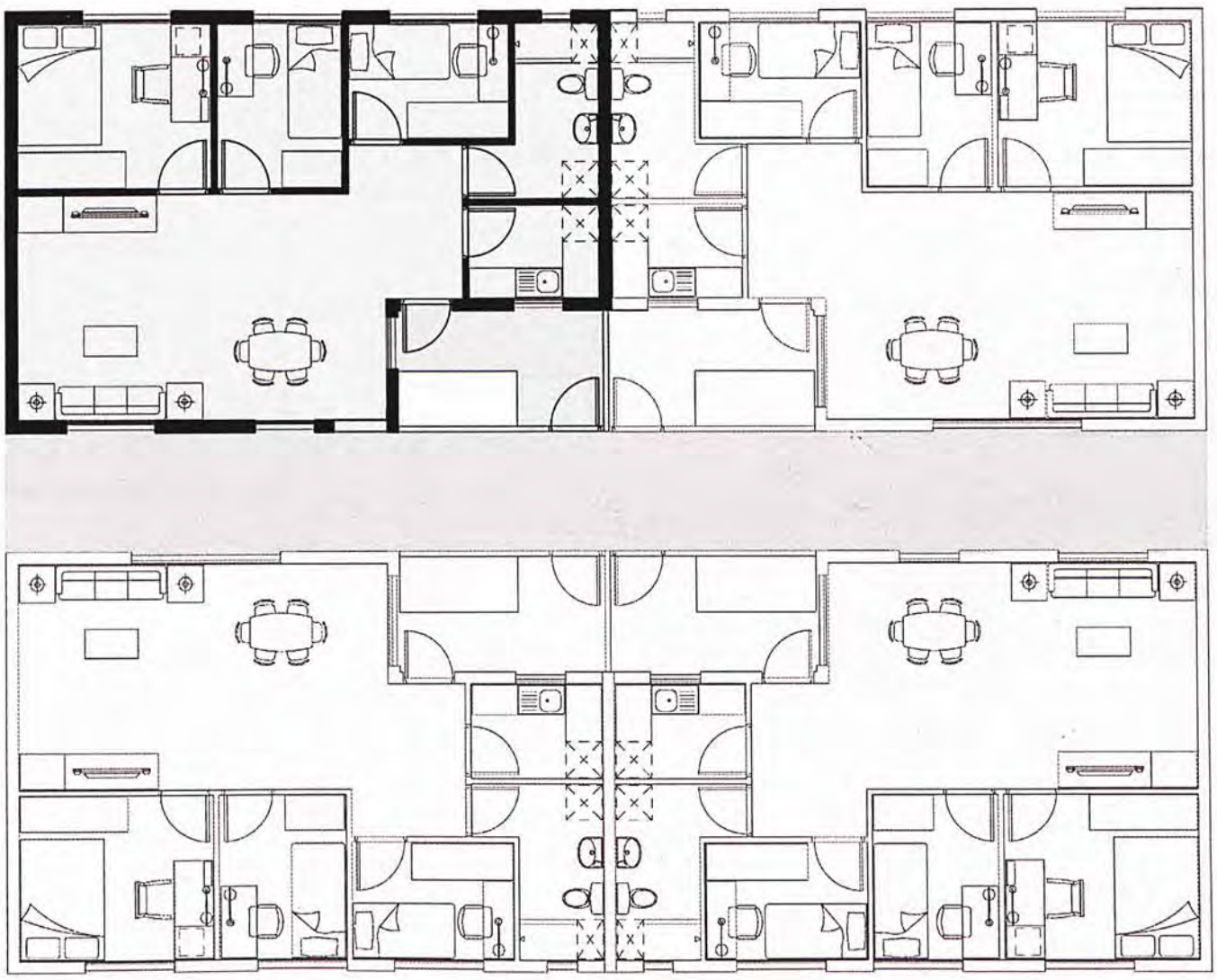
Total No. of Units : 708



TYPE 1 - Unit with one bedroom
Area = 31.68 m^2
No. of Unit = 242 (35%)

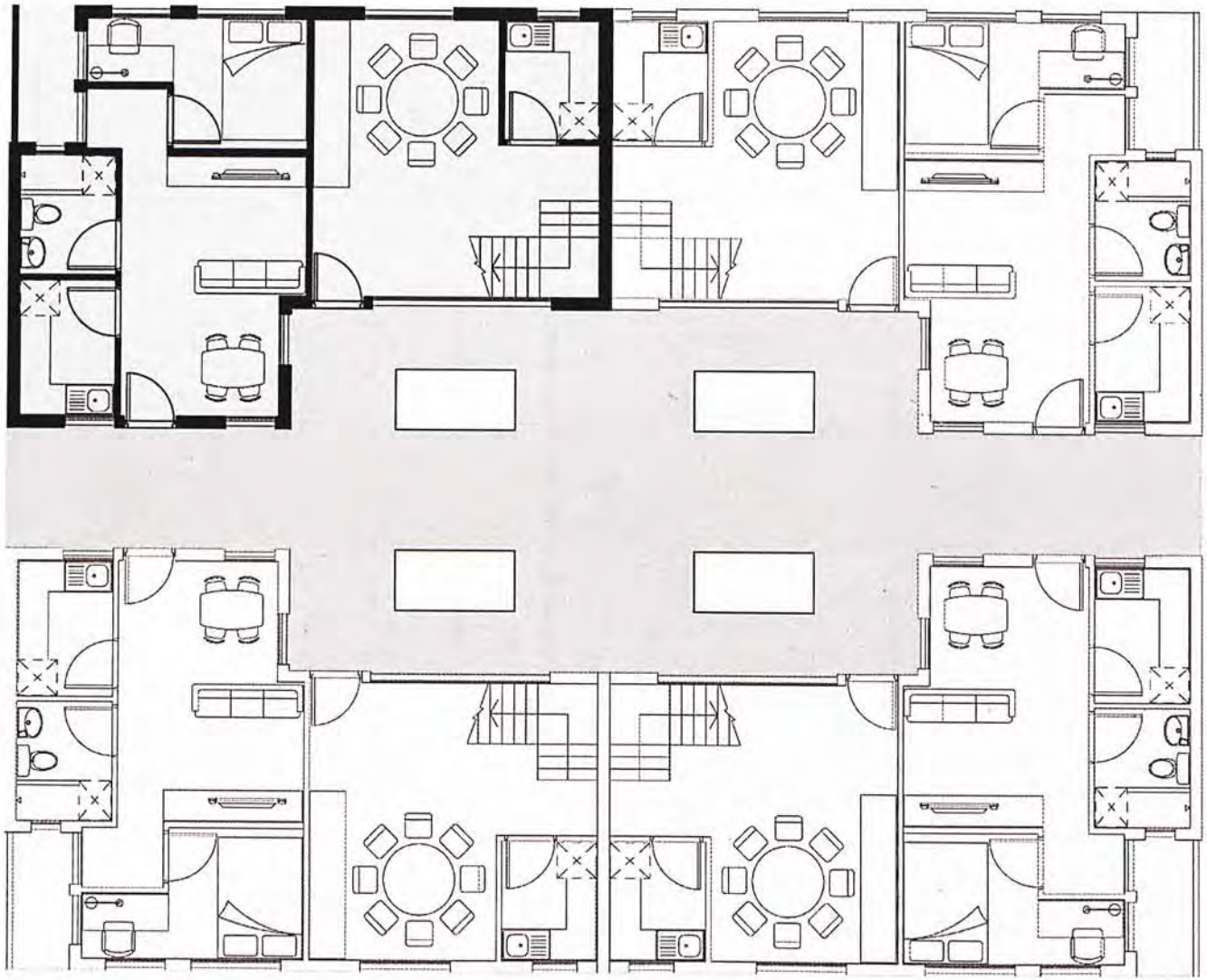


TYPE 2 - Unit with two bedrooms
Area = 48.18 m^2
No. of Unit = 201 (30%)

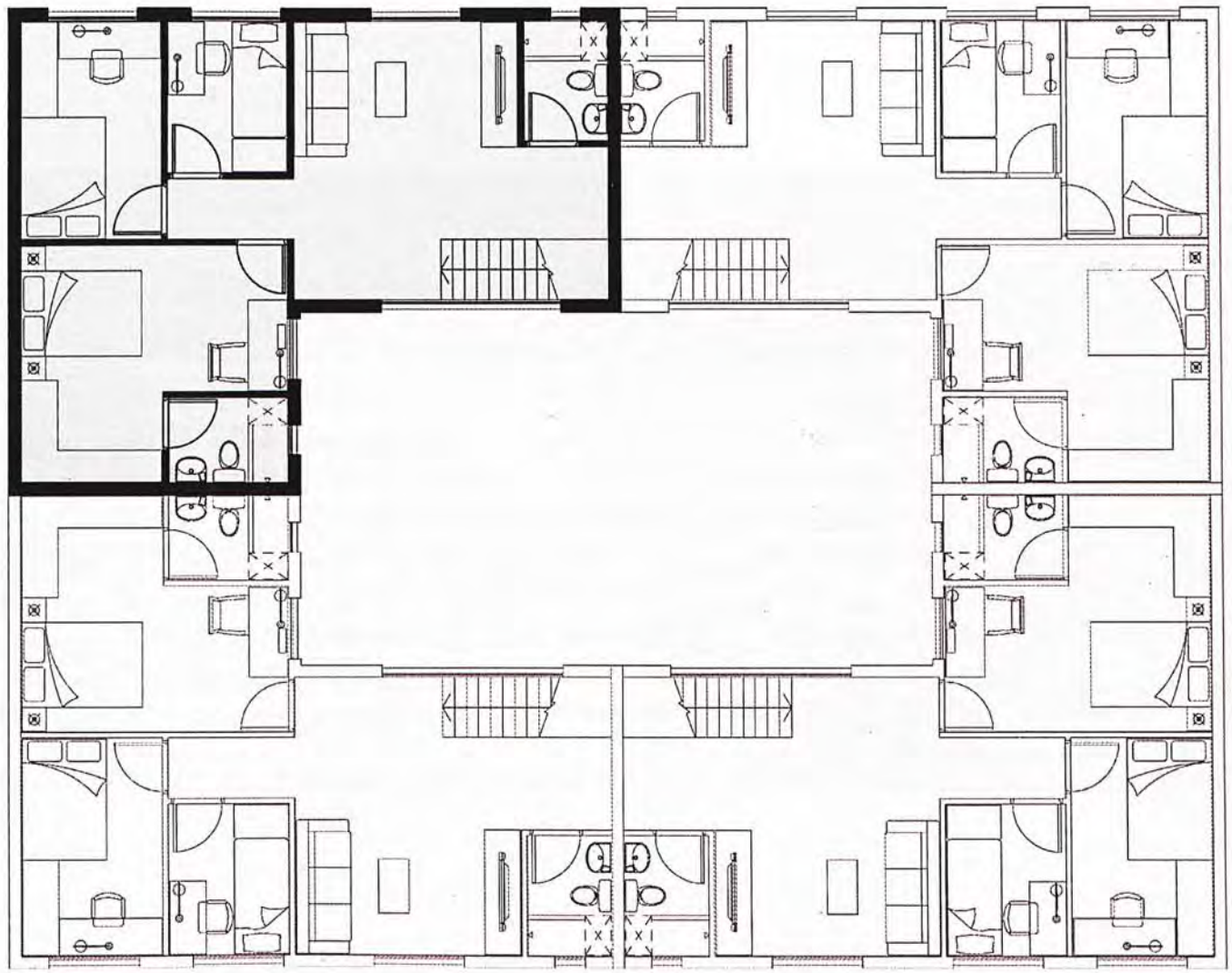


TYPE 3 - Unit with three bedrooms
Area = 62.68 m^2
No. of Unit = 187 (25%)

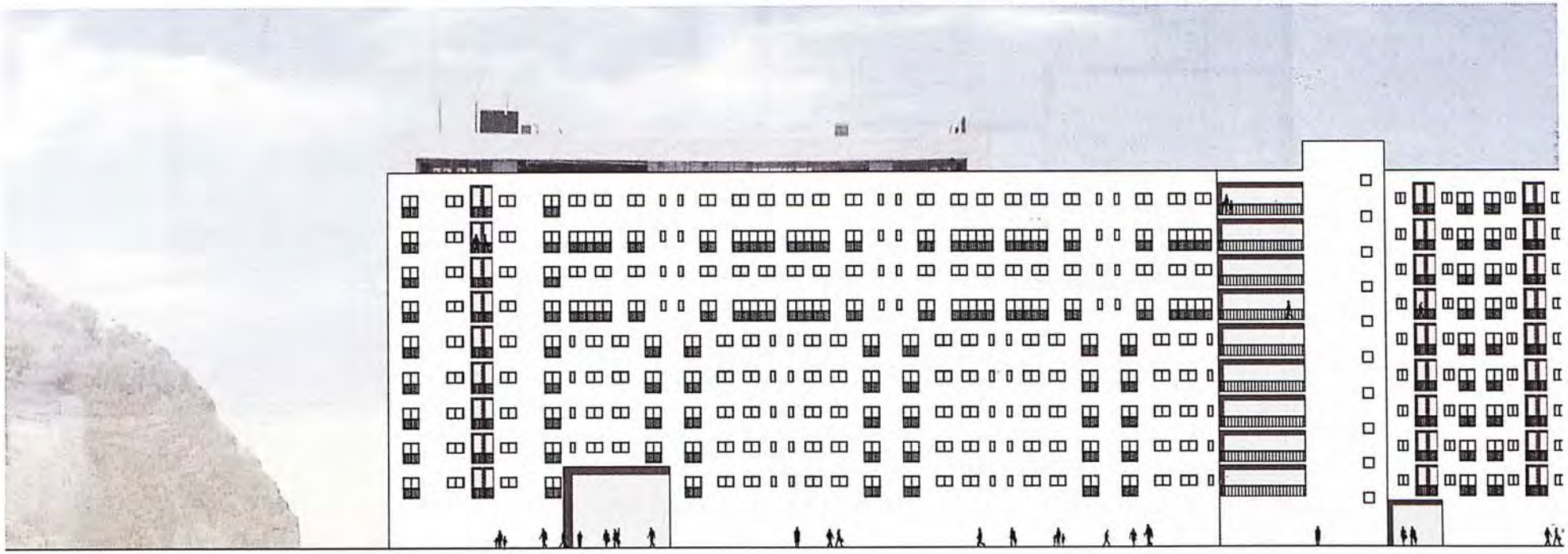
0 1 2 5m



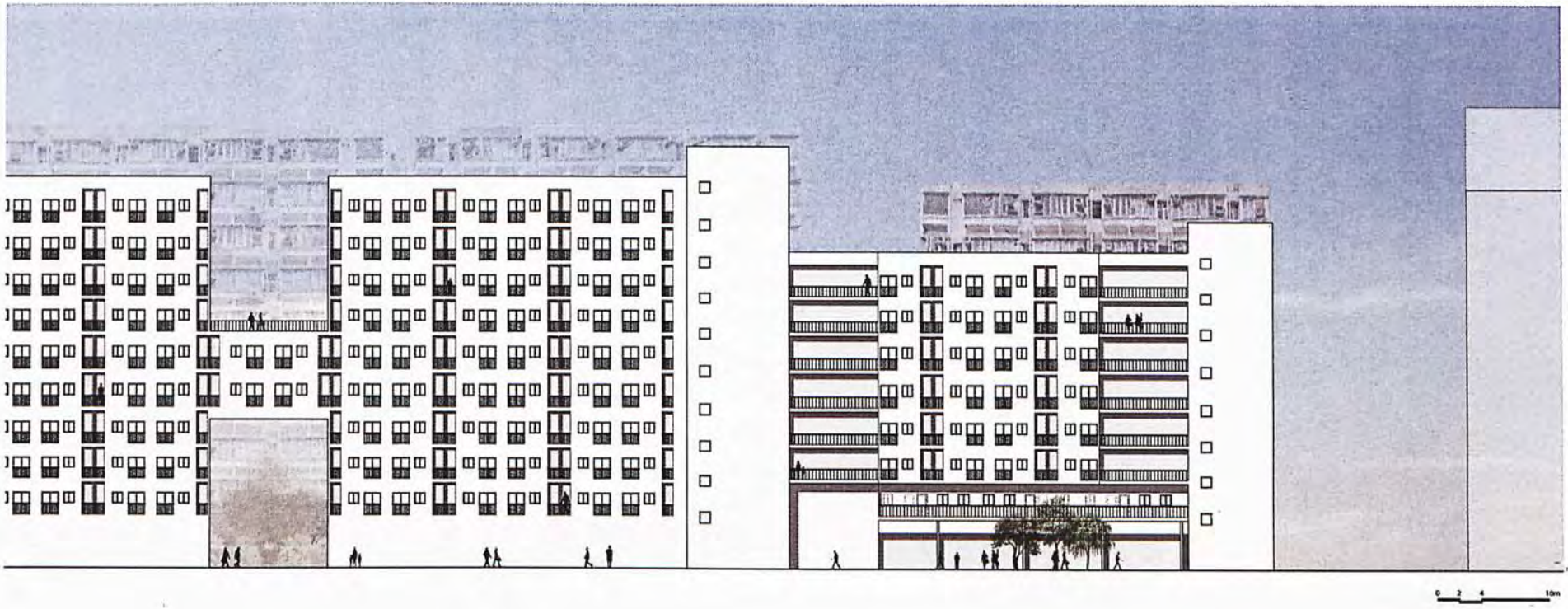
TYPE 3 - Duplex with four bedrooms
Area = 31.68 m^2 + 80.73 m^2
No. of Unit = 78 (10%)

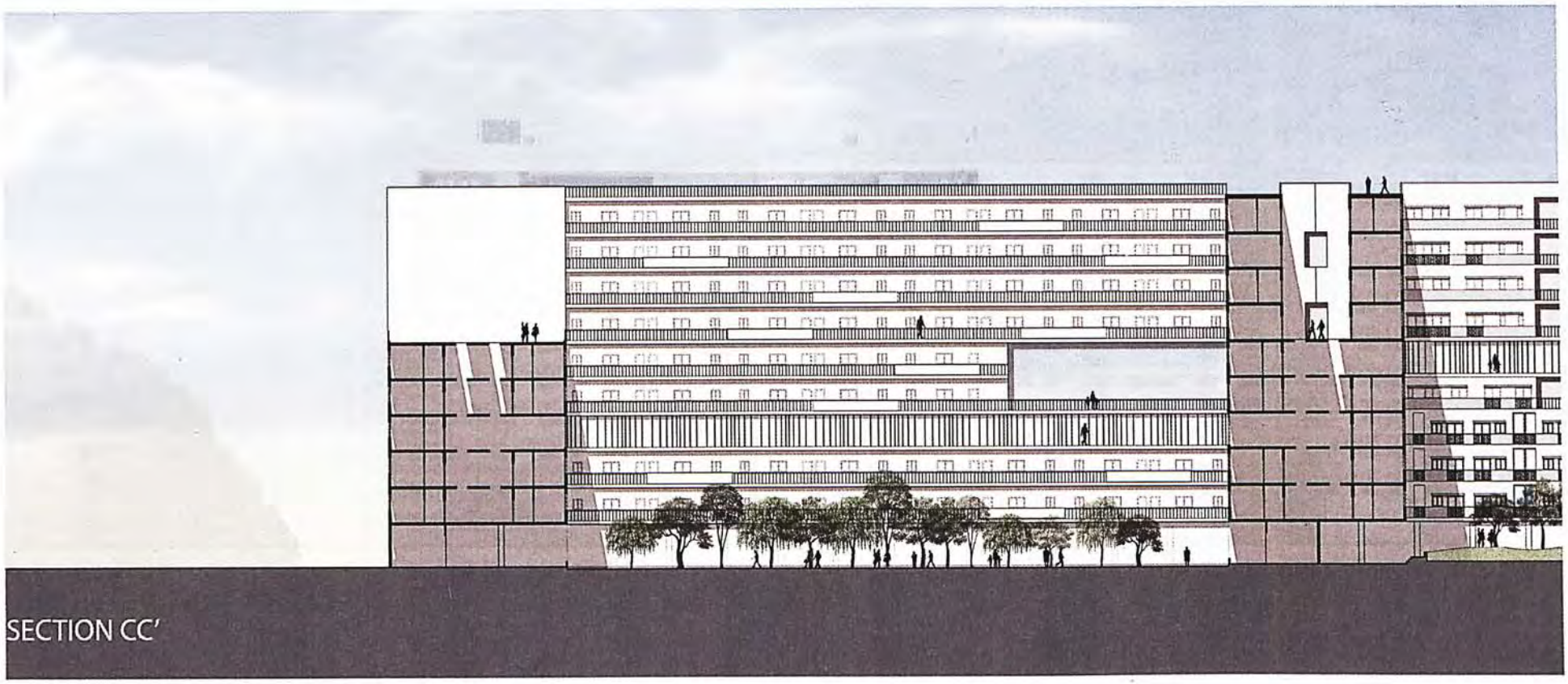


0 1 2 5m

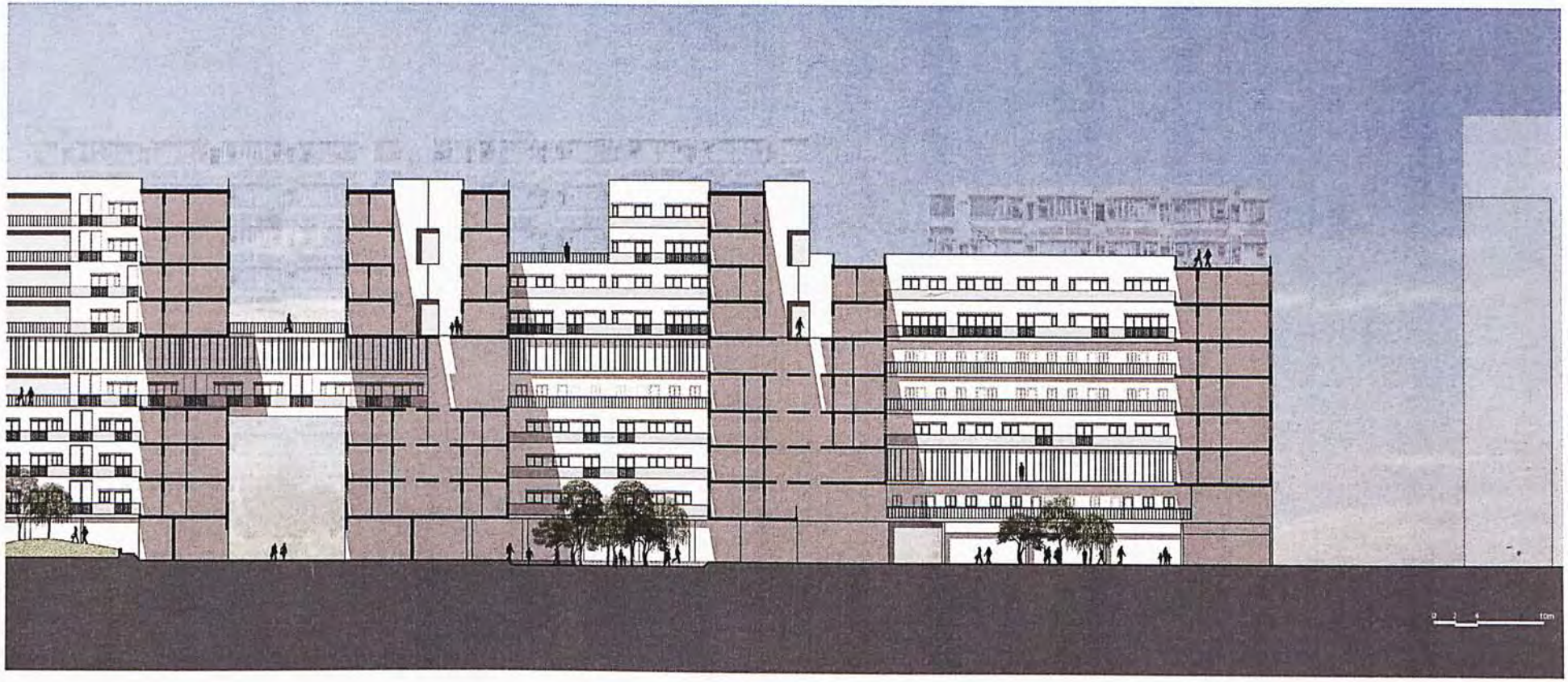


SOUTH ELEVATION


0 2 4 10m



SECTION CC'



SPATIAL SEQUENCE

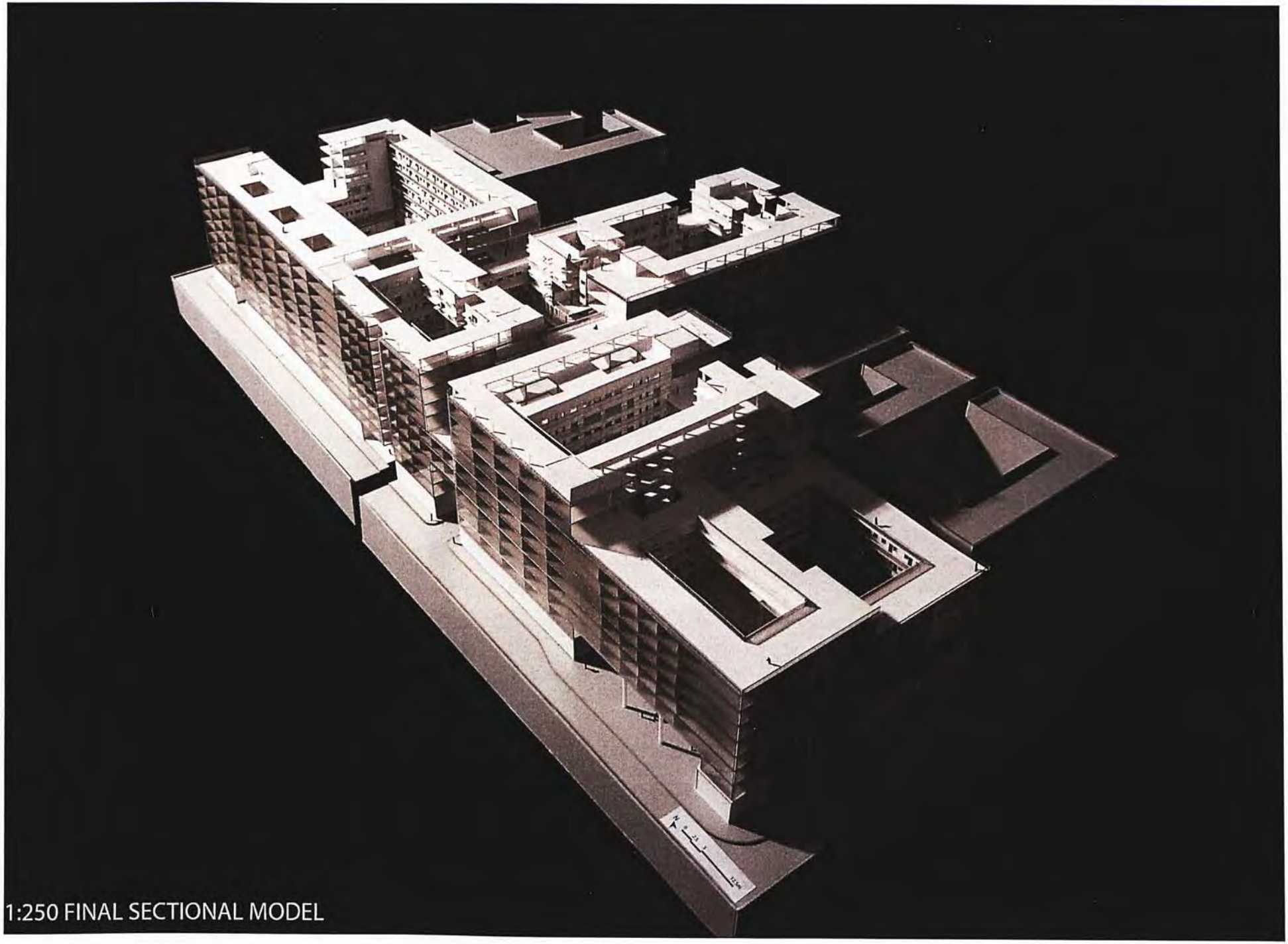
QUADRANGLE (LARGE)

COURTYARD (MEDIUM)

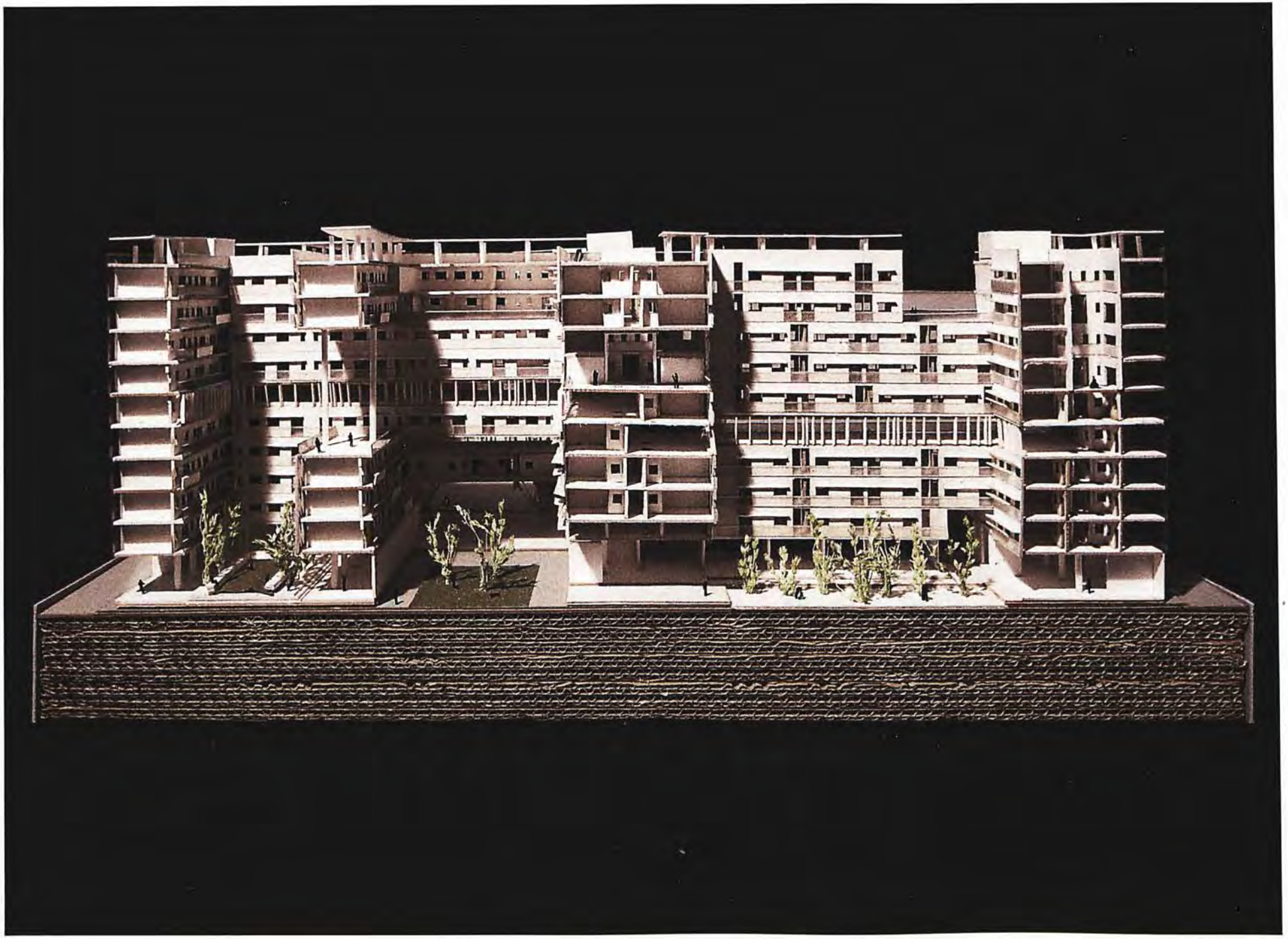
WALKING PATHWAY AROUND COURTYARD

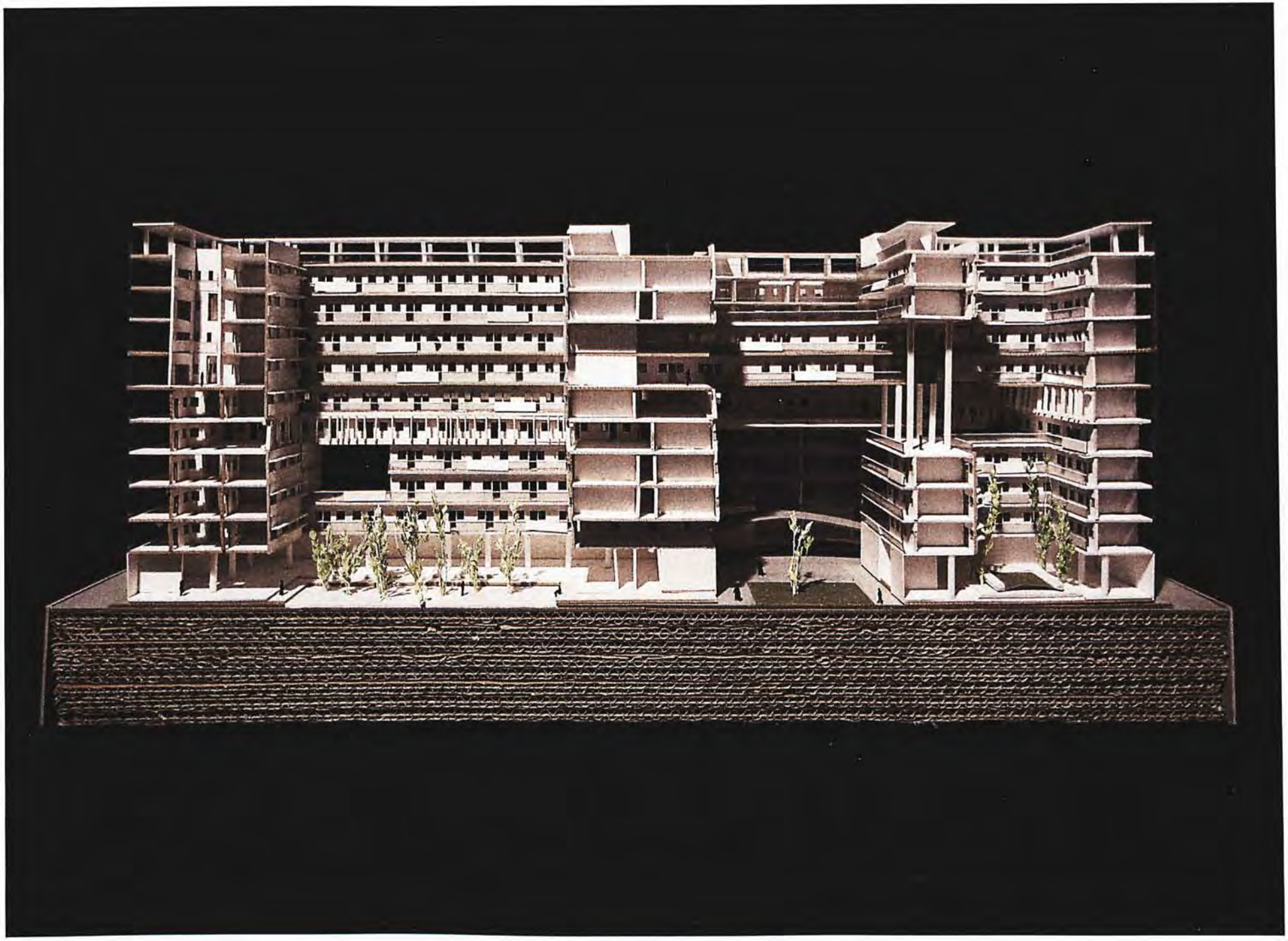
COURTYARD (EXTRA SMALL)

CORRIDOR WITH LIGHT WELL



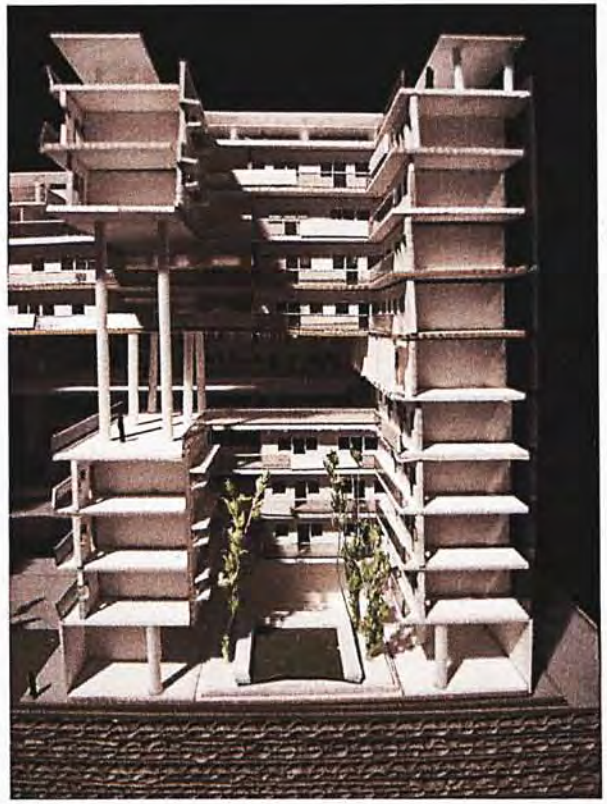
1:250 FINAL SECTIONAL MODEL





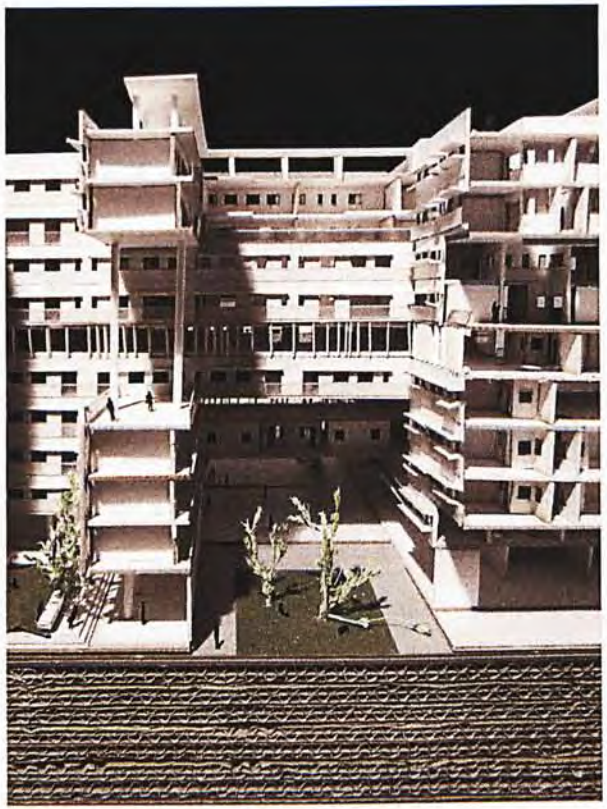
COURTYARDS (SECTIONAL VIEWS)

LARGE COURTYARD



MEDIUM COURTYARD

SMALL COURTYARD AT UPPER LEVEL



EXTERNAL COURTYARD

CONNECTION BETWEEN COURTYARDS

EXTERNAL VIEWS

ENTRANCE

EXTERNAL COURTYARD

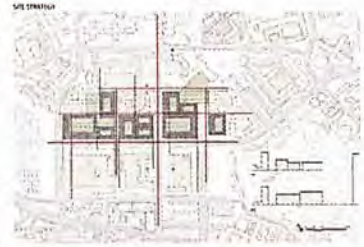
TERRACE

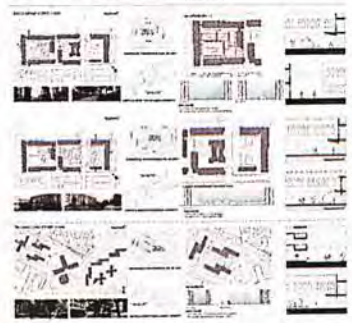
ROOF GARDEN

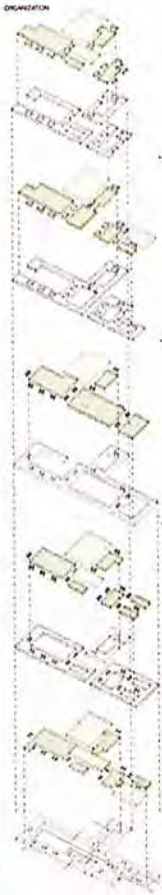
COUTYARDS IN MASS HOUSING

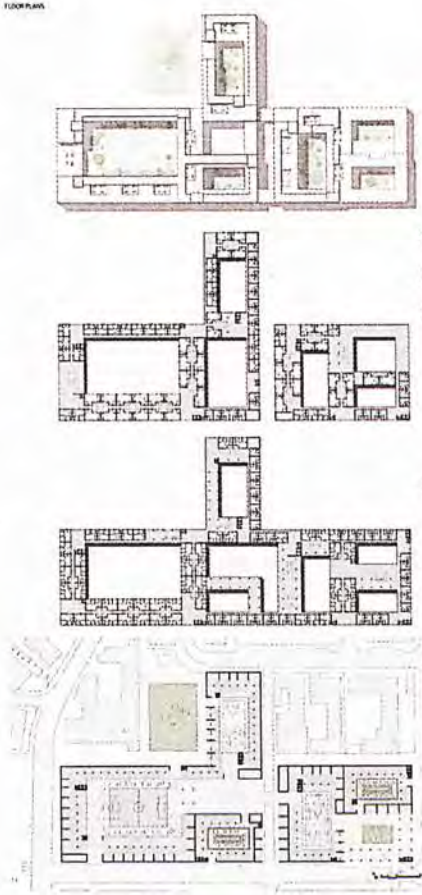
Applying the concept of courtyard house and quadrangle in housing estate into mass housing in Hong Kong

LAI PUI MAN , Emily
Advisor: WOO, Pui Lang









Lai Pui Man 1009032150
Advisor: WOO, Pui-leng Leng

COURTYARD IN MASS HOUSING

Applying concept of courtyard house and quadrangle in housing estate into mass housing in HK

Concept of Courtyard House in Mass Housing

The courtyard house, with the enclosed inner courtyard, enables a relatively dense settlement with numerous dwellings. It represents an alternative to the problematic development of public districts using detached houses in some foreign countries. The function of the courtyard house is symbolically united with the fundamental meaning of living: sheltered enclosure and openness to the outside world. The courtyard house has remained a valid residential type over thousands of year. Due to the above advantages mentioned, is the concept of courtyard house suitable in Hong Kong with a high density? Could the courtyard house be applied on the mass housing in Hong Kong?

Definition

Oxford Dictionaries Online

For the definition of the "courtyard" from Oxford Dictionary, it is *an unroofed area that is completely or partially enclosed by walls or buildings, typically one forming part of a castle or large house*. Its variant is "court".

Courtyards : aesthetic, social, and thermal delight, John S. Reynolds, 2002

In courtyard house, it is *an enclosed area that is outside yet almost inside, open to the sky, usually in contact with the earth, but surrounded by rooms or buildings*. It is closely related to its surrounding rooms, serving them as both a conduit and a filter of daylight, night darkness, wind, rain and sound. Courtyards provide people with daily contact with nature and moderate nature's extremes.

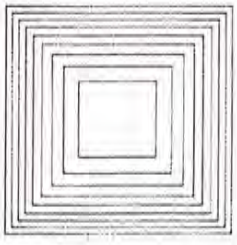
Oxford Dictionaries Online

The synonym of courtyard is "Quadrangle". It is *an open square area that has buildings all around it, especially in a school or college*. It is the courtyard in larger scale. For the courtyard in smaller size, it is called "air well" which is mainly for lighting and ventilation issues.

Theory

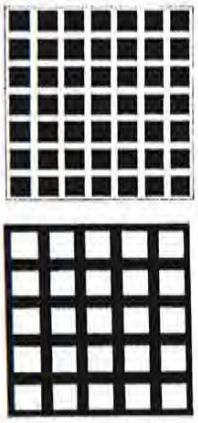
"Grid as Generator"(1969-1972) by Leslie Martin

In 1969-1972, Leslie Martin and his partner Lionel March did some studies on the grid or framework by using mathematical calculation and models. They used the Fresnel's diagram as a reference to calculate proportion of solid and void in urban aspect.



"The Grid as Generator", Urban space and Structures, Leslie Matin, 1969-1972

In the Fresnel's diagram, each successive annular ring diminishes in width but has exactly the same area as its predecessor. The outer band in the square form of this diagram has exactly the same areas as the central square…The central square (which can be called the pavilion) and the outer annulus (which can be called the court) are two ways of placing building



on the land. On any large site a development covering fifty per cent of the site could be plotted as forty-nine pavilions and exactly the same site cover can be plotted in court form. With the same plot ratio, there are widely different effects of placing exactly the some count of floor space on the same site.

Leslie Martin has already shown that the urban pattern with courts could fulfil the density or plot ratio requirement in towers by mathematical method. It can enhance the environment in the city and provide more spaces for the residents. However, the courts shown by Leslie Martin are in same size. For further development, the size of the court should be varied. Courts in different sizes could be served for different purposes in the design, for example, football court in large courtyard and rest garden in smaller one.

"Site Planning" by Kevin Lynch

In Kevin Lynch's book, "Site Planning", he mentioned about the courtyard house and the court arrangement. He pointed out the characteristics and advantages of courtyard house and court arrangement.

Courtyard House

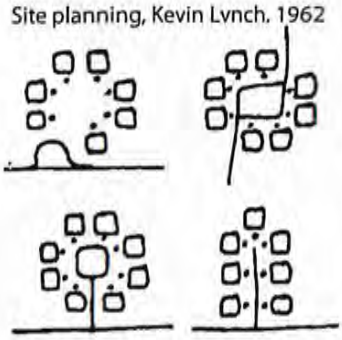
Site planning, Kevin Lynch, 1962

The courtyard house, in which single-family units are packed closely together, side by side and back to back, and have their open space within their walls rather than outside of them. This derives from an old Mediterranean prototype, and allows the privacy, control, and directness of access of single-family houses to be provided at much higher densities.

Certainly, the advantages of the courtyard house should be kept while applying the concept in mass housing. The courtyard in courtyard houses is inward looking. The courtyard is for the member in the family. In mass housing, the units located around the courtyard should be treated as a whole, just like a very large family. Each courtyard is mainly served for one "family". The units should face to the courtyard to create the sense of inward looking.

Court Arrangement

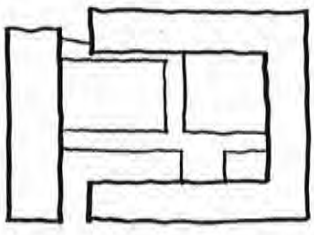
Site planning, Kevin Lynch, 1962



Court arrangement is that groups of units are faced inward on a common open space. This is done primarily for social and visual reasons: to promote neighborly relations and to provide pleasant enclosed spaces. ... The court with its circulation may shrink to the width of a cul-de-sac. The internal space of the court or cul-de-sac may be open to the street, forming an inlet of the major street space, or the entrance may be narrowed or even formalized with a gateway, so as to produce an independent space.

The court arrangement mentioned by Kevin Lynch focuses on the allocation of the single-family houses to provide an enclosed open space in the centre. In my interpretation, it could be applied in mass housing, in a large scale. The building blocks could be arranged to create court to "promote neighbourly relations and to provide pleasant enclosed spaces".

La Tourette (Monastery with Living Cells), Le Corbusier, Lyon, 1957-1960
Cloister



La Tourette : the Le Corbusier monastery, Anton Henze, 1966

Cloister pathways cuts through the square of the courtyard, linking the monastery wings and the church along the shortest line. Despite their symmetrical positioning, the courtyard corridors have one blank and one glazed wall with ondulatoires. The traditional perimeter cloister is displaced to the roof as a solitary walk. Prayer walking round and round the flat roof beneath arches that were supposed to have crowned the edifice. *A wall measuring 1.83m (the height of a man) was put up to prevent the monks from gazing out to the maze of surrounding hills, thus ensuring that they concentrate on the spiritual task on hand.*

Living Cells

The Monastery of Sainte Marie de La Tourette, Philippe Potié, 2001

There are two floors of cells on the top of the monastery. One arrives in a corridor that runs along the three wings of living quarters leading to all the cells. *The corridor is 2.26m wide with 33cm-high horizontal slits placed at a height of 1.42m. The slits offer visitors long zoom like views of the building's interior shapes. The theme of the strip window is afforded a cinematic dimension, serving as a backdrop to the architectural narrative of the cloister as it unravels like a ribbon.*

The large courtyard is divided into four parts by the cloister pathways. On the upper level, four courtyards are combined into a large courtyard which is enclosed by the living cells. Terrace is formed on the roof level on the cloister. It creates variations for the courtyard and its privacy vertically. It is one of the methods for changing the privacy from lower to upper level in my design.

On the other hand, the courtyard in La Tourette or other cloisters is different with the courtyard in housing. There should be some interaction between the courtyard and the surrounding rooms in housing. Although this kind of courtyard is not suitable for housing, it could be applied in my design for another programme such as kindergarten as a variation

For the façade treatment, four types of façade design are used in differ-

ent parts of the monastery, i.e. concrete frame with glass panels at library, glazed wall with ondulatoires at cloister pathway, wall with a slit at corridor of living cell and solid concrete wall on the roof level of the cloister according to their transparency. Greater transparency is for the interaction between inside and outside and lighting enhancement. Smaller transparency or even opaque wall could be served as isolation. Different façade treatment should be used for different programme or spatial requirement according to its opacity.

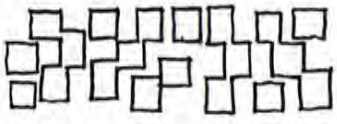
Function of Courtyard by SANAA

Different kinds of courtyards always appear in the work of SANAA. In the concept of Sejima, different kinds of courtyard applied have their own functions in each case. The functions generally are "Exchangeability between Interior and Exterior" and "Atmospheric Effect".

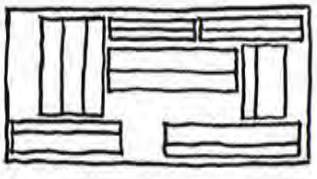
Exchangeability between Interior and Exterior

Architectural Topology, El croquis no. 139, 2008

It is based on the equality of geometric figures between the interior areas and the courtyards, which makes them equivalent to each other on the building's plan.



In the Seijo Town Houses in Tokyo 2005/2007, a variety of outdoor spaces extend the interiors: courtyards at basement level, the small gardens on the ground floor and terraces on the roofs of some of the volumes. These are outdoor living spaces that establish relationships of equivalence with the rooms in the different apartments.



The proposed design of Centre for the Illinois Institute of Technology Campus done by SANAA has a series of longitudinal courtyards with equivalent shapes and sizes to the work areas. It uses the size and shape parameters to deny the hierarchical distinction between indoor and outdoor spaces, and establish an equivalence between them.

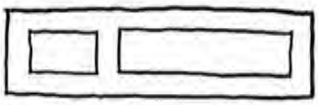
Atmospheric Effect

Architectural Topology, El croquis no. 139, 2008

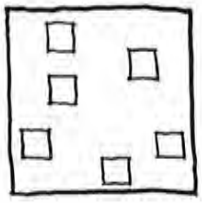
The atmospheric effects in Sejima and Nishzawa's buildings are produced by the qualities – transparent, translucent, reflective – of the materials used for walls, including the boundary of the courtyard. In many cases, however, the way these walls are arranged is also an important part of this effect.

Project Summary, El croquis 121/122, 2007

The continuity of the transparent glass walls in the Novartis office Building in Basel, 2002/2006, and the narrowness of its bays – arranged around a courtyard – *"benefits a high degree of transparency and equal exposure to the surroundings and the courtyard"*. The effect that this has on a visitor to



the building is one of great openness throughout the building while one's gaze crosses the bays directly due to their narrowness.



On the third floor of the Zollverein Design School, which contains office around six courtyards and a perimeter corridor, the user experiences multiple transparencies and overlapping reflections between the corridor, the courtyards, the work areas, the roof terrace and the sky through this courtyards.

From the points mentioned above, the two main functions are related to the relationship between inside and outside. In my design, the relationship between the courtyard and the building blocks should be specially considered. Inside and outside merge together at the profile of the building by the form of the architecture while outside is brought to inside and is enclosed for the internal courtyard. The layer for dividing inside and outside i.e. the boundary of the courtyard is also considered in order to enhance the "overlapping" of different spaces such as corridor and courtyard etc.

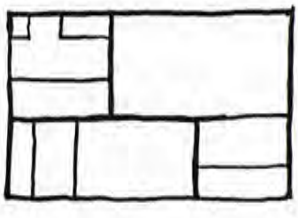
"Court-house" by Mies van der Rohe
At the beginning of the 1930s, Mies van der Rohe brought the idea of the courtyard house to life in urban forms which enabled open and spacious living within the constraints of expensive urban land.

Mies van der Rohe, Philip C. Johnson, 1978

From 1931 to 1938 Mies developed a series of projects for "court house"... in which the flow of space is confined within a single rectangle formed by the outside walls of courtyard and house conjoined.

West meets East : Mies van der Rohe, Werner Blaser, 1997

... The design has permeation of interior and exterior and the opening to the garden extending the full width of the house.



Each house is relatively small and enclosed in glass. It spans the width of the lot, which is defined by brick walls abutting the house. A large open area provides a relatively expansive view from the main living areas and distances the house from the street. Smaller, paved courts at the back of the lot are more introspective and bring light and air into the more private areas of the house.

The courtyards in Mies's "Court house" are different from the definition of the courtyard. They are not located in the centre and are not enclosed by rooms only. While applying the concept in mass housing, the wall could be replaced by building blocks certainly. However, the arrangement and location of the courtyard in the "House with Three Courts" and "Group of Court

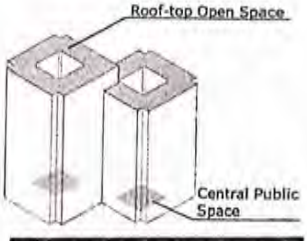
House" could act as a reference. The courts in different sizes are located within a rectangular profile. The indoor spaces and the courts interlock to each other. The plan could be enlarged as a reference for the layout of the mass housing.

Housing in Sham Shui Po

In order to understand the housing estates in Hong Kong, Sham Shui Po was selected as a study area. Sham Shui Po was one of the earliest developed districts in Hong Kong, Sham Shui Po was already a densely populated district in 1950s and 1960s. As of 2003, Sham Shui Po is covered mainly by residential buildings, with public housing estates built on approximately 810,000 m2 of land. Sham Shui Po is an area where urban decay is serious in Hong Kong. Most of the old public housings in Sham Shui Po (e.g. Shek Sip Mei Estate and Pak Tin Estate etc.) are under redevelopment. There are old and new types of public housing in this district for study.

There are fifteen housing estates in Sham Shui Po District. They were arranged in a timeline according to their building age. They could be divided into three groups "courtyard created clearly" (1960-1977), "unclear courtyard created" (1980-1989) and "no courtyard" (1993-2004). The first group is with clear courtyard enclosed by slab blocks. The plot ratio is about 3 to 5. There are courtyards with unclear boundary in the estates defined as second group. The buildings in these estates are mainly double H, or triple H blocks. Lots of lost space is created in this kind of courtyard. Its plot ratio is extremely low, around 2 to 3. The third group is mainly the estates with harmony towers or cross-towers. No courtyards are created. The plot ratio is very high, 5 to 7.

Critique



There is an example of applying courtyard into mass housing in Hong Kong. It is the twin tower type of the public housing built in 1980s. There is a "light well" in each tower with 24-storey and 21-storey height respectively. The courtyard in the middle on the ground floor is a playing area of the areas. It helps in the lighting and ventilation issue. The corridors facing the courtyard help the security aspect. Since the building height is tall, the feeling in the courtyard is not very well. The plan of every floor is the same. The only light source is from the hole at the top. It is quite dark in the courtyard. Not much people would like to stay in the courtyard for activities. The concept applied is good, but the design of the kind of housing block should be enhanced.

Mass housing with courtyards

Contemporary City, Le Corbusier, 1922

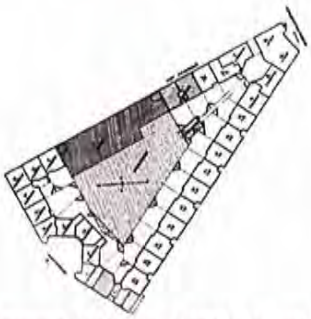
In the Contemporary City from Le Corbusier, Le Corbusier pointed out that the open spaces should be increase and the distances to be covered should be diminished. The city's residential quarters must no longer be built along "corridor-street", full of noise and dust and deprived of light. The urban dwellings are away from the street without small internal courtyards and with the windows looking on to large parks. This is the type with "set-backs" or on the cellular principle.

The residential blocks with set-backs have 120 inhabitants to the acre. These are the luxury dwellings. The buildings with "set-backs" have six double storey with no internal wells. The flats are facing on either side on to immense parks. 85% of the ground is open for gardens, sports grounds. The "set-backs" supply an architectural motive which takes us far from the "corridor-street". Every window of every room (and that on both frontages) looks on to open spaces.

The residential blocks in cellular system have a similar number of inhabitants. The buildings have "hanging gardens", looking on to immense parks with no internal well. These are "service-flats" of the most modern kind. 48 % of the ground is open.

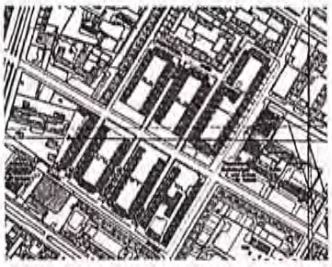
It is the city planning project by Le Corbusier in the 1920s. The idea of the Contemporary City with high density should be suitable in Hong Kong. Apart from the tower form, the housing blocks could be similar to the form of "the cellular system" and "setbacks" which could provide more open space and enhance the quality of living environment. It is the "dream mass housing" in the past. We should try to apply it in Hong Kong to get its benefit.

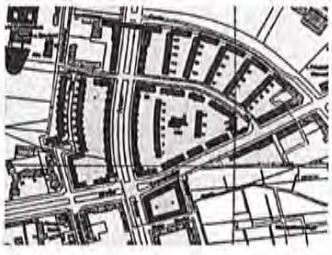
Perimeter Block in Amsterdam



There are different kinds of Perimeter Blocks in Amsterdam. Housing block with post office, Oostzaanstraat, Hembrugstraat, Amsterdam (1917) by M. De Klerk was chosen to study. A triangular courtyard is enclosed by the housing blocks. The housing blocks are facing the main road with the courtyard at the back. The residents share the large courtyard.

In Amsterdam, perimeter blocks are applied in everywhere. The above courtyard is in triangular form. However, other blocks could be in different sizes and forms such as rectangular shape. The courtyard concept applied in mass housing, perimeter block has great flexibility. It could be applied in different situations.

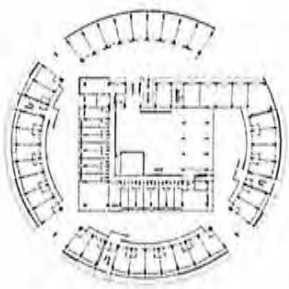




Housing Estates in Berlin

Two housing estates in Berlin were studies, Carllegien Estate, Berlin (1930) by Bruno Taut & Franz Hillinger and White City, Berlin (1931) by Otto Rudolf Salvisberg, Bruno Ahreds & Wilhelm. In the Carllegien Estate, U shape residential blocks are facing each other to create a large courtyard visually. The courtyard is divided by a road in the middle to form two courtyards physically. The White City is mainly divided into two parts. In the first part, courtyards are created by enclosing four sides. In the second part, L shaped buildings are arranged in sequence to form courtyard in-between.

Different kinds of method to create courtyard in massing housing in the same city, Berlin are shown in the above cases. In my design, different enclosure or method should be applied in different courtyards to create some variations.



Urban-Tulou (2008) in Guangdong Nanhai by Urbanus

Urban-Tulou is a housing complex for low-income families in China with the concept of Tulou, a large courtyard in the middle. A rectangular loop is placed in the centre of a cylinder with varying height. Apart from the central courtyard, there are four in-between courtyards. Five courtyards are located in the Tulou.

Since the density and situation in Guangdong is similar to Hong Kong, it is a good reference for Hong Kong. The units are small which is suitable in Hong Kong. This example proves that the concept is workable in Hong Kong as a supportive case.

Courtyard House Study

There are different kinds of courtyard houses in the world with different style, characteristic and requirement. In order to understand more about courtyard house and find out the essence of the courtyard, the investigation on courtyard houses in different countries is conducted.

Tu Lou, Kai Shing Lou (1709)

It is the largest Tulou in Fujian with four-storey height. The ancestral hall is located in the middle of the plan on ground floor. A library is surrounded the ancestral hall. The private rooms are location on first to third floors.

Traditional Chinese courtyard house

The traditional Chinese courtyard house has two rectangular courtyards

at the middle and two open lanes at then front and back respectively. People enter the courtyards in sequence from the front to the back. The courtyards at the front are mainly for guests. The courtyards at the back are more private.

Court cave house

It was built underground. It has only one large courtyard at the centre of the house connecting all rooms. Its circulation is very simple and direct. The entrance connects to the courtyard direction. People pass though the courtyard to enter the rooms.

City Mansion, India (15th century)

It has three courtyards in the house, one courtyard in the center from ground floor to forth floor and two courtyards (one storey deep) on the second floor. The courtyards are built in different level with different depth and privacy.

Talaie House, Yazd, Iran (late 18th to early 19th century)

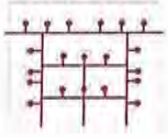
It has five courtyards with different sizes. Each courtyard is for specific target groups, men, women and guest due to the religion aspect. For different climate, courtyards for summer and winter quarters were built. The fifth courtyard is for the kitchen.

Turkistani House, Bukhara (18th to 19th century)

It has three irregular courtyards for men, women and kitchen respectively. The irregular shape of the courtyards relies on the profile of the house. The edges of the courtyard are parallel to the profile of the house.

Apart from the foreign courtyard houses, the local courtyard houses, Sam Tung Uk in Tsuen Wan and Tsang Tai Uk (1867) in Shatin are studied.

Sam Tung Uk in Tsuen Wan

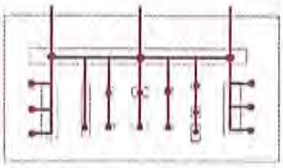


It is formed by eighteen houses. Each house has one small courtyard at the entrance. Its circulation is in network to connect the houses or courtyards by lane.

The network of lane is outdoors, formed by front lane, middle lane, rear lane, right lane and left lane.

Tsang Tai Uk (1867)

Apart from the small courtyard at the entrance of the house, there are

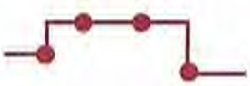


three linear courtyards in the village. The linear courtyard is treated as common place in front of the house for the residents.

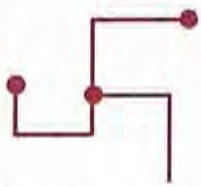
Summary

The height of the courtyard house is around one to four storey tall. The courtyard created could be in various shapes respectively. In traditional Chinese courtyard house, they are in rectangular while circular courtyard created in Tulou. On the other hand, irregular courtyards are located in the Turkistani House. The irregular shape mainly relies on the alignment to the profile of courtyard house or the site. Apart from the profile of the site, the shape of the courtyard also related to the form of the context for the coherence.

The proportion and size of the courtyard is an important factor of the quality and environment of the courtyard. For example, the sun light penetration and ventilation is affected by the proportion and size of the courtyard. Aspect ratio (floor area / (average wall height)^2) is one of the measurements of the relationship between the size and the depth of courtyard. A high aspect ratio indicates greater courtyard exposure to the sky. Shallower courtyard (larger aspect ratio), the more evident is the sky or plants framed against it, the edges of the rood become a frame for a shifting and unpredictable panorama. Deeper courtyards (smaller aspect ratio) emphasize the walls and their openings rather than the sky. The wide and shallow courtyard will often be a sunny collection of plants and water, while the narrow, deep courtyard will be shady and more reverberant with sounds of water and birds. The main concern of dimension and height of the courtyard is for the light penetration to ensure the courtyard not in darkness.



IN SEQUENCE



BRANCH

In some of the cases, there is more than one courtyard in one house. Circulation applied to connect the courtyards is different in the studied case. They are mainly classified in four types, direct, in sequence, branch and network. The circulation between courtyards could be applied in the mass housing design. Several courtyards should be located in a housing estate. The circulation between them should be considered. For the optimum complexity, combined circulation (in sequence and branch) is suitable in scale of mass housing. Besides, there is an arcade surrounding or next to the courtyard as a transition between indoor and outdoor. The arcade could also be applied in the mass housing to act as a covered semi-open space around the courtyard as a transition.

Quadrangles in Housing Estate

The research mainly focuses the open space in the housing estate in the

selected district, Sham Shui Po. Most of the housing estates were developed in a large lot with different kinds of facilities inside. In fifteen estates in Sham Shui Po District, five estates was selected, So Uk Estate (1960), Tai Hang Sai Estate (1965), Shek Kip Mei Estate (1976), Tai Hang Tung Estate (1980) and Lee Cheng Uk Estate (1984). In these estates, seven courtyards with potential were chosen. Each of them has different enclosure and their own characteristics.

While studying the courtyards, different criteria are studied as below: -
- Enclosure
- Proportion
- Height of a Courtyard
- Aspect Ratio
- Number of Units Shared a Courtyard
- Size and Division
- Covered walkway and canopy
- Accessibility

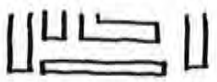
So Uk Estate

It is enclosed in "U" shape by the snake shaped building. It is like the "setbacks" in Contemporary City of Le Corbusier. At the opening edge, a platform (1.5 m tall) defines the boundary of the courtyard. It is smaller comparing to other selected courtyard. The corridors on the upper level are facing the courtyard. There are shops at the edge of the courtyard.

Tai Hang Sai Estate -1

It is a square courtyard which is enclosed in U shape and is bounded by the platform (0.8m tall) physically. The open side is enclosed visually by the residential blocks at the opposite side, which is separated with the courtyard by a road. There is only one entrance for the courtyard. The courtyard has single use, rest garden.

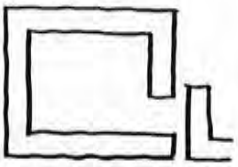
Tai Hang Sai Estate -2



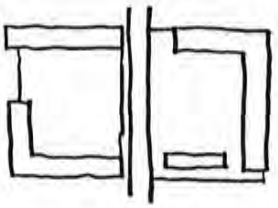
It is in linear shape and enclosed discontinuously by the residential buildings. It gives a sense of movement instead of a gathering area. The main use of this courtyard is only for circulation. The human flow in this area is great. The design used different language on the surfaces facing this courtyard (solid, with windows and with a corridor) which has different reflection rate and transparency.

Shek Kip Mei Estate -1

It is enclosed by the buildings at four sides totally. An opening as one of the

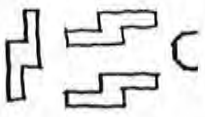


entrances is created by cutting and shifting. Its large area is divided into five divisions by fences or planters for different programs, volleyball court, basketball court, football court, rest garden and smoking area.



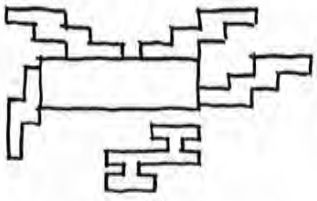
Shek Kip Mei Estate -2

This courtyard is on the podium level. It is enclosed totally in two U shaped blocks. It is divided into two parts by the road in the middle. However, it is treated as one large courtyard visually while locating in the courtyard. There are commercial activities at the edge of the courtyard, retail shops and restaurant. Some temporary canopies are created by the users.



Tai Hang Tung Estate

It is enclosed by "double slab" buildings with lots of lost space created. The courtyard is not totally enclosed. The enclosure is less then 60%. The boundary of this courtyard is unclear. In the lost space, it could not give you the sense of direction and it is difficult to distinguish your location.

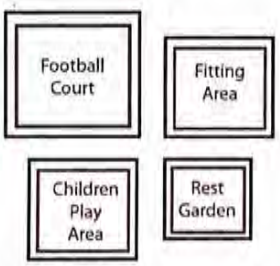


Lee Cheng Uk Estate

It is bounded by podium physically and is enclosed by surrounding buildings visually. It is a large courtyard surrounded by canopy and covered walkway.

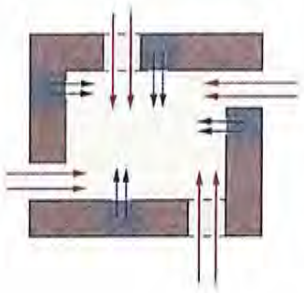
Summary

Smaller size preferred



Larger area is divided into parts with programs while smaller area with less divisions programs is preferable. It can enhance the uniqueness and wholeness of the courtyard. The size of courtyard in Tai Hang Sai estate -1 is optimum to ensure the quality of courtyard and the shared area for the units.

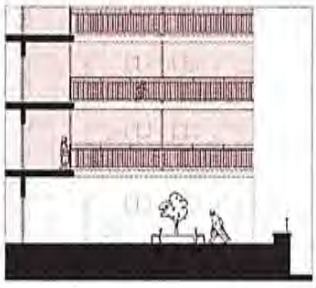
Three kinds of accessibility



There are three kinds of accessibility which should be concerned. The first one is from buildings, mainly the residents. Besides, people could enter the courtyard from the openings. The third one is from outside but passing though the building. These accesses could maintain the human flow of the courtyard. These kinds of accessibility should be considered in the mass housing design

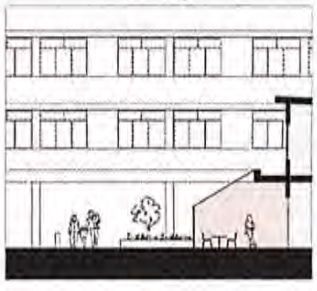
Corridor facing the courtyard as a variation

Different treatment on the surfaces facing this courtyard (solid, with windows and with a corridor) which has different reflection rate and transparency. The corridor facing the courtyard could provide Interaction be-



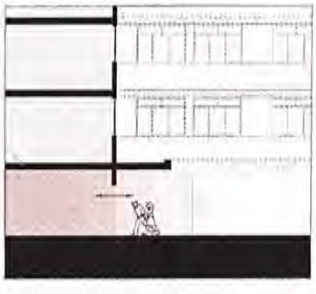
tween the corridor on the upper level and courtyard. Wider corridor could provide more communal space but it has low reflective rate which would make the courtyard become darker. The façade with window or the white solid façade could help to reflect light to enhance the lighting issue in the courtyard. Different façade treatment should be applied in the four internal façades of the courtyard. Façade with corridor is for interaction between the courtyard and the upper level while window or solid façade is for reflection of light.

Covered walkway and Canopy



The covered walkway could create a walking path for pedestrian and have a guiding effect. People could stay under the canopy for activities too. A semi-open layer is created as a transition between the residential blocks and the open courtyard. Covered walkway or canopy should be placed in the edge of the courtyard to serve for people passing though the courtyard and ensure that they do not disturb the activities in the courtyard. This could help me divide the space for users and pedestrians.

Open shop at the edge of courtyard for Commercial Activities



There are different kinds of shops or other commercial activities at the edge of the courtyard. For example, retail shops or restaurant are open to the courtyard, which is preferable. On the other hand, offices, workshop and kindergarten, which are closed and private do not have much relationship with the courtyard. If commercial program is located in the courtyard, the program should be selected carefully. Commercial activities open to the courtyard on the ground floor could be one of the design options.

Site analysis

The selected site is between the Shek Kip mei Estate and Tai Hang Sai Estate. It is under construction now for the redevelopment of Shek Kip Mei Estate. 40-storey public housing tower will be built in the site. The site is divided into two lots by Nam Cheong Street. There are mainly in residential and institutional use around the site.

Design Strategy

Grid

A grid framework is set for the mass housing with courtyards in urban planning. It is formed by two narrow strips and one wide strip. The narrow strips are for the width of mass housing (8m for block with single-loaded corridor). For blocks with double-loaded corridor, the wide of the blocks is 16m (two strips). The wide strip is for the width and length of the courtyard. According to the Hong Kong Buildings Ordinance, min. length of rectan-

gular horizontal plan of the habitable area is 1/3 of building height, about 10m for the separation between building and building. In order to reserving space for balcony, the width of the courtyard, i.e. width of the strip is set at 13m. Since there are some reference lines from the context, the gridlines in y-axis are adjusted to fit the site.

Increasing privacy from lower part to upper part

As a residential project, the residential inside would like to have certain privacy in their places. So, the upper level of the complex is more private to give a secure and quiet environment for residents. Open courtyard on ground floor allows the public use. Non-residents of the estate could come and have gathering in the courtyard. It provides a communal space for the community and also enhances interaction between the residents and the community.

Sizes of the courtyards

Courtyards in different sizes are placed in the site, mainly categorized in three sizes, i.e. large, medium and small size. There are different treatment and enclosure in different sizes of courtyard. Quadrangle is mainly for the large courtyard, like a public square. The remaining one is more enclosed. Apart from quadrangle and courtyard, air wells are applied in the double-loaded corridor to enhance the ventilation and lighting.

Courtyards with unclear boundary

At the corner of the site, there are some partially enclosed open spaces. They are enclosed in L or U shape only. However, their boundary is mainly defined by the context, for example, the façade of surrounding building. Besides, the open space next to the site is extended.

Intersection and junction of loops

There are three kinds of intersection, three loops joining together, two loops joining together and two loops touching each other at the corner. While loops joining together, double loaded corridor are placed at the overlapping length of the loop. On the other hand, there are three kinds of junctions, L-shaped junction with two directions, T-shaped junction with three directions and Cross-junction with four directions. The vertical cores are placed at these junctions for the circulation to different directions and structural support.

Inward looking to the courtyard

One of the characteristics of courtyard housing is inward looking. Corridor and terrace are mainly located facing the courtyard while window façade

mainly faces outward. However, or the lighting issue, one or two window façades are placed at the internal façades of the courtyard. Besides, holes on the elevation are created for lighting and activity space.

Ground floor layout

Agora in Miletus acts as a reference for the ground floor layout. Layer of columns are located to form directing and guiding effect. A continuous route with some branches is formed to connect all the quadrangles and courtyards. For different courtyards, a specific quality is embedded and active or passive program is plugged in. More shops are located in the quadrangle for a busier atmosphere. Quiet environment without shops is created in the small courtyard. Some shops with two open-ends are located for connecting the internal and external courtyards.

Walking path around the courtyard

A walking path around the courtyard is located in each courtyard at different level. Vertical fins are installed at the walking path with different separation. A dramatic effect is formed while sunlight penetrates into the walking path. People could walk in the looped path just like walking in a cloister.

Façade treatment

Different façade treatments are used for the external and internal facade. For external façade, purged window design is used. Horizontal language is applied for internal façade. Horizontal fins aligned the railing in the corridor are added. On the other hand, different sun-shading devices are installed for the internal façade facing different directions. For the elevation facing east, thin horizontal fins are added on the top of windows. While facing south, shelter is added. Double deeper horizontal fins are located on the top and at the bottom of the windows. Sliding screen panels are attached to the windows in order to block the sunlight to enter the living units.

Units

708 units are created in the project including 242 units with single bedroom (31.68m^2), 201 units with two bedrooms (48.18m^2), 187 units with three bedrooms (62.68m^2), 78 duplexes with four bedrooms (31.68+80.73m^2). The first two kinds of units are located in the single loaded block. The units with three bedrooms are at the lower levels with light wells at the double-loaded corridor for better ventilation and lighting. The duplexes are at the upper floors enclosing a small and private courtyard. Each duplex unit is attached to a unit with one bedroom for a family living with their parents or grandparents.

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